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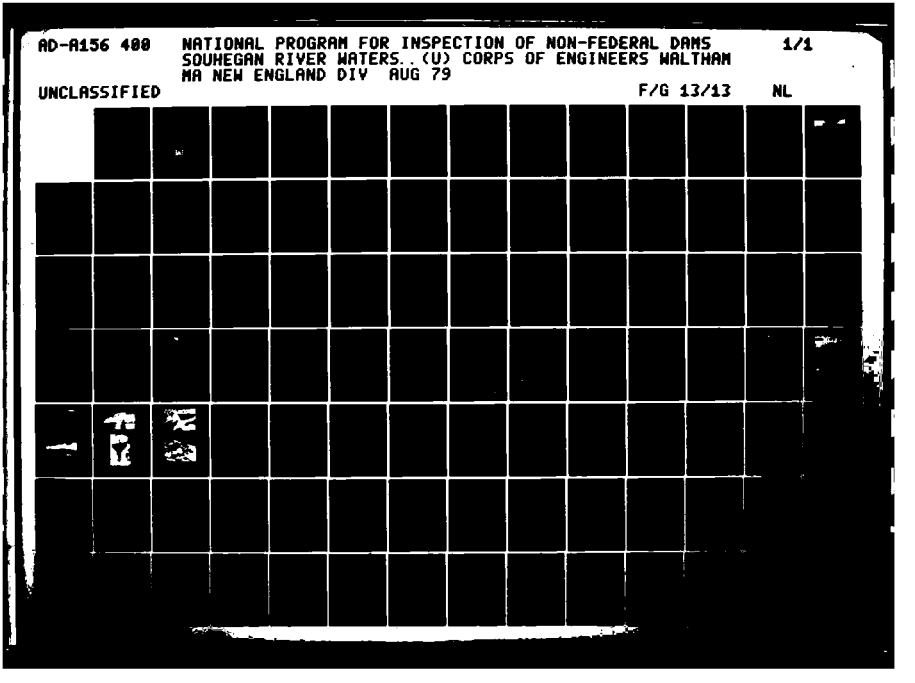

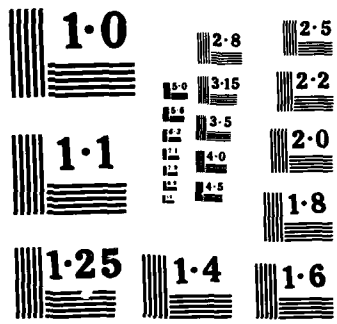

NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

MERRIMACK RIVER BASIN
WILTON, NEW HAMPSHIRE

SOUHEGAN RIVER WATERSHED
DAM NO. 10A

NH 00264

NHWRB 254.33

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

AUGUST 1979

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

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Merrimack River Basin
Wilton, New Hampshire
Mill Brook, a Tributary of the Souhegan River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is an earth embankment 951 ft. long and 59 ft. high. The dam is intermediate in size with a high hazard potential. The dam is in good condition at the present time. It is recommended that the owner retain the services of a registered professional engineer to investigate the cracking and erosion of the outlet conduit.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED

SEP 24 1979

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

I am forwarding to you a copy of the Souhegan River Watershed Dam No. 10A Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire and owner of the project.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely,

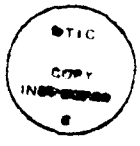
Max B. Scheider

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

SOUHEGAN RIVER WATERSHED DAM NO. 10A
NH 00264

MERRIMACK RIVER BASIN
HILLSBOROUGH COUNTY, NEW HAMPSHIRE



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

PHASE I REPORT

Identification No.:	NH 00264
NHWRB No.:	254.33
Name of Dam:	SOUHEGAN RIVER WATERSHED DAM NO. 10A
Town:	Wilton
County and State:	Hillsborough County, New Hampshire
Stream:	Mill Brook, a Tributary of the Souhegan River
Date of Inspection:	May 1, 1979

BRIEF ASSESSMENT

The Souhegan River Watershed Dam No. 10A is located on Mill Brook approximately one mile upstream of Davisville, New Hampshire. The dam is an earth embankment 951 feet long and 59 feet high with a drop inlet service spillway structure and a 30 inch outlet conduit. An earth emergency spillway 220 feet wide is cut into the left abutment. An earth emergency spillway 110 feet wide is cut into the right abutment.

The dam is owned by the New Hampshire Water Resources Board. It was designed by the Soil Conservation Service for the purpose of flood protection in the Souhegan River Watershed.

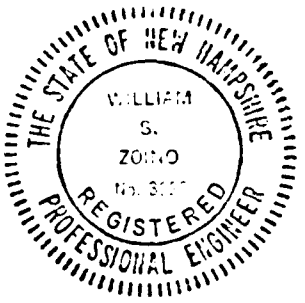
The drainage area of the dam covers 6.4 square miles and is made up primarily of mountainous woodland. The dam impounds only 48.6 acre-feet at low stage but has a maximum impoundment of 2770 acre-feet. The dam is INTERMEDIATE in size and its hazard classification is HIGH since significant property damage and loss of life could result in the event of a dam failure.

The test flood for this dam is the Probable Maximum Flood. The peak inflow for this flood is 13,700 cfs. Because of storage, the resulting peak discharge is 9,500 cfs compared to a maximum spillway capacity of 14,686 ± cfs. The water surface would be at elevation 850.5 feet (MSL) or 1.5 feet below the top of the dam for this flood.

The dam is in GOOD condition at the present time. It is recommended that the owner retain the services of a registered professional engineer to investigate the cracking and erosion of the outlet conduit. Remedial measures to be undertaken by the owner include filling in tire ruts, mowing of slopes, removing debris from emergency spillway, including operation of drain

gate in the annual inspection procedure, and developing a formal written emergency flood warning system for the dam. The program of annual technical inspections should be continued.

The recommendations and improvements outlined above should be implemented within two years of receipt of this report by the owner.



William S. Zoino
N.H. Registration 3226

Nicholas A. Campagna, Jr.
California Registration 21006

This Phase I Inspection Report on Souhegan River Watershed Dam No. 10A has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.

Joseph A. McElroy

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Joseph W. Finegan, Jr.

JOSEPH W. FINEGAN, JR., CHAIRMAN
Chief, Reservoir Control Center
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the Test Flood should not be interpreted as necessarily posing a highly inadequate condition. The Test Flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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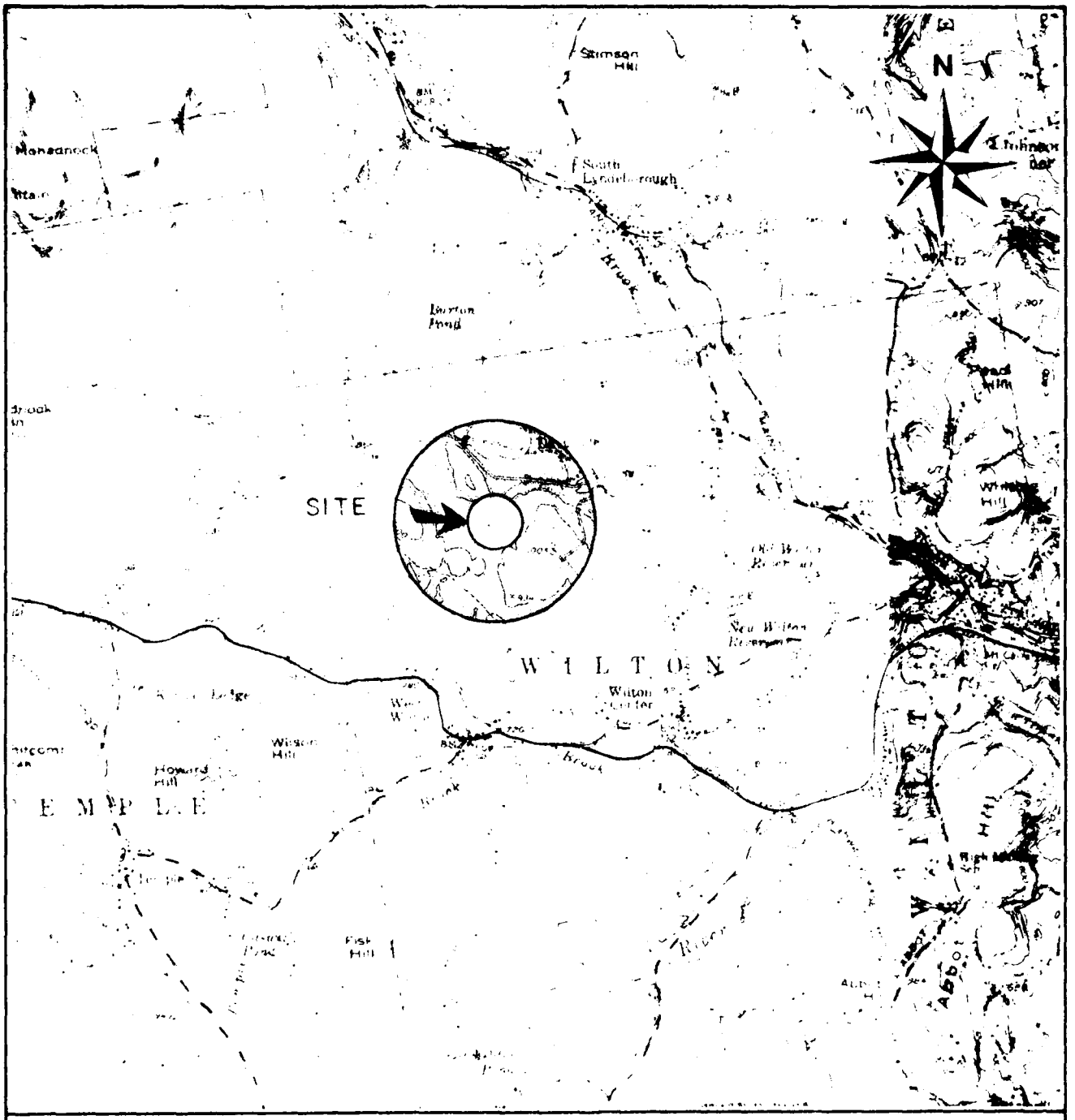

— SCALE —

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FROM: USGS PETERBOROUGH & MILFORD - N.H. QUADRANGLE MAPS

GOLDBERG, ZOINO, DUNNICLIFF & ASSOC., INC GEOTECHNICAL CONSULTANTS NEWTON UPPER FALLS, MASS.	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCUS PLAN

FILE No. 2327

SOUHEGAN RIVER WATERSHED

DAM No. 10A NEW HAMPSHIRE

SCALE	AS NOTED
DATE	MAY 1979

V

PHASE I INSPECTION REPORT

SOUHEGAN RIVER WATERSHED DAM NO. 10A

SECTION 1

PROJECT INFORMATION

1.1 General

(a) Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Goldberg, Zoino, Dunnicliff & Associates, Inc. (GZD) has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to GZD under a letter of March 30, 1979 from Colonel John P. Chandler, Corps of Engineers, Contract No. DACW 33-79-C-0058 has been assigned by the Corps of Engineers for this work.

(b) Purpose

1) Perform technical inspection and evaluation of non-federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-federal interests.

2) Encourage and prepare the states to initiate quickly effective dam safety programs for non-federal dams.

3) Update, verify, and complete the National Inventory of Dams.

(c) Scope

The program provides for the inspection of non-federal dams in the high hazard potential category based upon location of the dams, and those dams in the significant hazard potential category believed to represent an immediate danger based on condition of the dams.

1.2 Description of Project

(a) Location

The Souhegan River Watershed Dam No. 10A is located on Mill Brook approximately one mile upstream of Davisville, New Hampshire (Township of Wilton). It can be reached from an access road off the Burton Highway, 3 miles north of Wilton, New Hampshire. The dam is shown on USGS Peterborough, N.H. quadrangle at approximately coordinates N 42° 51.0', W 71° 48.2'. (See location map on pave v). Figure 1 of Appendix B is a site plan for this dam.

(b) Description of Dam and Appurtenances

The dam consists of an earth embankment with an earthfill cutoff trench below the embankment, a principal spillway with a reinforced concrete riser and outlet pipe, and two emergency spillways located at the left and right abutments. The total length of the dam is 1,281 feet, of which 220 feet is the left emergency spillway and 110 feet is the right emergency spillway.

1) Embankment (See pgs. B-3, B-4, B-5 & B-9)

The embankment is made up primarily of silt and silty sand (designation ML-SM using the Unified Soil Classification System). It is 951 feet long and is a maximum of 59 feet high. The upstream slope is 3 horizontal to 1 vertical; the downstream slope is 2.5 horizontal to 1 vertical; and the width of the crest is 14 feet.

Beneath the embankment is an earthfill cutoff trench which is 24 feet wide at the bottom. According to available plans, it is constructed of the same material as the embankment. The cutoff trench was designed and constructed to extend through sand and gravel layers to underlying glacial till or bedrock.

2) Principal Spillway (See pgs. B-7 & B-8)

The principal spillway consists of a reinforced concrete drop inlet structure with a sluice gate controlled inlet pipe and two uncontrolled orifice inlets, a 30 inch outlet pipe supported on a concrete cradle, and an impact basin.

The inside dimensions of the riser structure are 42.5 feet high and 7.5 feet wide normal to the axis of the dam. It is 2.5 feet long parallel to the embankment and flares to 14.2 feet long at the top. The walls of the structure are 10 inches thick for the top 18 feet, 12 inches thick over the next 10 feet, 15 inches thick over the next 7 feet, and 18 inches thick for the bottom 7 feet. The top slab is 10 inches thick.

At the base of the structure, a transition toe has been monolithically cast outside the walls of the primary structure. It is 6 feet long and makes the transition from a 2.5 foot by 4.5 foot opening in the riser structure, to a 30 inch diameter outlet conduit. The riser structure and toe are founded on a reinforced concrete spread footing.

At the base of the structure is a 24 inch diameter, vertical lift, sluice gate inlet which is controlled by a wheel operated bench stand with a rising stem. A 24 inch diameter concrete pressure pipe extends 63 feet upstream from the lift gate into the impoundment pool. The pipe is supported on a concrete pad and a reinforced concrete inlet structure is located at the upstream end. This inlet structure is protected by a galvanized trash rack.

The "low stage inlet" is an uncontrolled opening approximately 19.8 feet above the sluice gate invert. It is one foot, 10 inches wide and one foot, 9 inches high and is located in the upstream face of the riser structure. The water flows over this orifice and drops into the riser structure. It is protected by a trash rack assembly approximately 11 feet high and 4.5 feet wide. This assembly is fabricated from galvanized steel angle sections.

The "high stage inlet" consists of two openings approximately 40 feet above the sluice gate invert. They are 7.5 feet wide and 15 inches high and are located in the left and right sides of the flared portion of the riser structure. They are protected by galvanized steel angles and 25 inch grating placed in front of each high stage opening. A 30 inch diameter manhole permits access into the riser structure.

The riser structure is drained by a 30 inch diameter reinforced concrete pressure pipe. It is approximately 288 feet long and drops approximately 4 feet over that length. The pipe penetrates the downstream

side of the riser structure and is supported by either a 4 inch thick concrete pad or a 7.5 inch concrete cradle (see pg. B-7). The support terminates in a 12 inch thick reinforced concrete cutoff wall at the downstream end. Plans indicate 8 concrete anti-seep collars cast around the pipe within the embankment. The pipe outlets into a stone revetted channel.

3) Emergency Spillways (See pgs. B-3 & B-4)

The left emergency spillway was excavated through till in the left abutment. It curves to the right around the embankment and is 220 feet wide at the control section. It is approximately 450 feet long and lies approximately 7 feet below the top of the embankment. The side slopes are 2.5 horizontal to 1 vertical on the abutment, and 4 horizontal to 1 vertical on the embankment.

The right emergency spillway was excavated through till in the left abutment. It curves to the left around the embankment and is 110 feet wide at the control section. It is approximately 700 feet long and lies approximately 7 feet below the top of the embankment. The side slopes are 2.5 horizontal to 1 vertical and 4 horizontal to 1 vertical.

4) Foundation and Embankment Drainage (See pg. B-6)

A trench drain extends from the outlet conduit toward the left abutment. It is 4 feet wide and a minimum of 6 feet deep. To the right of the outlet conduit is a trench drain with an 8 inch perforated, corrugated metal pipe. It is 4 feet wide and of variable depth. Each of these drains outlets in an 8 inch diameter outlet drain running parallel to the outlet conduit.

There are also trench drains protecting the left slope of the left emergency spillway.

(c) Size Classification

The dam's maximum impoundment of 2770 acre feet and height of 59 feet place it in the INTERMEDIATE size category according to the Corps of Engineers' Recommended Guidelines.

(d) Hazard Potential Classification

The hazard potential classification for this dam is HIGH because of the significant economic losses and

potential for loss of life downstream in the event of dam failure. Section 5 of this report presents more detailed discussion of the hazard potential.

(e) Ownership

The dam is owned by the New Hampshire Water Resources Board, 37 Pleasant Street, Concord, New Hampshire 03301. They can be reached by telephone at area code 603-271-3406.

(f) Operator

The operation of the dam is controlled by the New Hampshire Water Resources Board. Key officials are as follows:

George McGee, Chairman
Vernon Knowlton, Chief Engineer
Donald Rapoza, Assistant Chief Engineer

The Board's telephone number is 603-271-3406. Alternatively, the Board can be reached through the state capital at 603-271-1110.

(g) Purpose of the Dam

The purpose of the dam is to reduce downstream flooding by providing temporary storage for the runoff from 6.4 square miles of watershed. This temporary storage is released through the low and high stage inlets of the principal spillway.

(h) Design and Construction History

The dam was designed by the U.S. Department of Agriculture, Soil Conservation Service in conjunction with the New Hampshire Water Resources Board. It was completed in 1967. The Soil Conservation Service provided full-time inspection during construction.

(i) Normal Operating Procedure

The dam is self regulating. The pond drain gate is operated as part of infrequent maintenance checks.

1.3 Pertinent Data

(a) Drainage Area

The drainage area for this dam covers 6.4 square miles. It is made up primarily of mountainous woodland with some pasture and minor development.

1) Outlet Works

Normal discharge at the site is through the 30 inch diameter outlet pipe. Water flows into this pipe either by flowing over the low stage orifice with invert elevation of 814.0 feet (MSL), or over the high stage orifices with invert elevation of 836.5 feet (MSL). In the event of severe flooding water would flow over the emergency spillway with crest elevation of 845.0 feet (MSL).

2) Maximum Known Flood

There is no data available for the maximum known flood at this damsite.

3) Ungated Spillway Capacity at Top of Dam

The capacity of the principal spillway with the reservoir at top of dam elevation (852 feet MSL) is approximately 149 cfs. The capacity of the emergency spillway is approximately 14,537 cfs at this level.

4) Ungated Spillway Capacity at Test Flood

The capacity of the principal spillway with the reservoir at test flood elevation (850.5 feet MSL) is 148 cfs. The capacity of the emergency spillway is 9,352 cfs at this level.

5) Gated Spillway Capacity at Normal Pool

There are no gated spillways with the exception of the gated pond drain inlet which is normally closed.

6) Gated Spillway Capacity at Test Flood

As previously mentioned, there are no gated spillways.

7) Total Spillway Capacity at Test Flood

The total spillway capacity at test flood elevation (850.5 feet MSL) is 9,500 cfs.

8) Project Discharge at Test Flood

The total project discharge at test flood elevation (850.5 feet MSL) is 9,500 cfs.

(c) Elevation (feet above MSL)

1) Streambed at centerline of dam: 790 ±

2) Maximum tailwater: Unknown

3) Upstream portal invert diversion tunnel: Not applicable

4) Normal pool: 814.0

5) Full flood control pool: 845.0

6) Spillway crest:

a) Pond drain inlet: 796.0

b) Low stage inlet: 814.0

c) High stage inlet: 836.5

d) Emergency spillway: 845.0

7) Design surcharge: 849.0

8) Top dam: 852.0

9) Test flood design surcharge: 850.5

(d) Reservoir

1) Length of maximum pool: 8,000 ± ft.

2) Length of normal pool: 1,500 ± ft.

3) Length of flood control pool: 7,800 ± ft.

(e) Storage (acre feet)

1) Normal pool: 48.6

2) Flood control pool: 1,529

3) Spillway crest pool:

a) Low stage inlet: 48.6

b) High stage inlet: 652

c) Emergency spillway: 1,529

4) Top of dam: 2,770

5) Test flood pool: 2,585

(f) Reservoir Surface (acres)

1) Normal pool: 7.6

2) Flood control pool: 140

3) Spillway crest pool:

a) Low stage inlet: 7.6

b) High stage inlet: 56 ±

c) Emergency spillway: 140

4) Test flood: 179

5) Top of dam: 203 ±

(g) Dam

1) Type: Earth embankment

2) Length: 951 ft.

3) Height: 59 ft.

4) Top width: 14 ft.

5) Side slopes: Upstream: 3 to 1
Downstream: 2.5 to 1

6) Zoning: Homogeneous

7) Impervious core: None

8) Cutoff: 24 ft. wide, earthfill

9) Grout curtain: None

(h) Diversion and Regulating Tunnel

Not applicable

(i) Spillways

1) Type:

a) Principal spillway: Reinforced concrete Drop Inlet

b) Emergency spillway: 2 grass covered earth channels cut in left and right abutments

2) Length of weir:

a) Pond drain inlet: 30 inch diameter pipe

b) Low stage inlet: 22 inches

c) High stage inlet: 15 ft.

d) Left emergency spillway: 220 ft.

e) Right emergency spillway: 110 ft.

3) Crest elevation (Ft. above MSL)

a) Pond drain inlet: 796.0

b) Low stage inlet: 814.0

c) High stage inlet: 836.5

d) Left emergency spillway: 845.0

e) Right emergency spillway: 845.0

4) Gates: 24 inch vertical lift sluice gate on pond drain inlet

5) Upstream channel: Reservoir

6) Downstream channel: Narrow channel to natural waterfall

(j) Regulating Outlet

The only regulating outlet is a 24 inch diameter pipe controlled by a wheel operated sluice gate. The pipe invert is at elevation 796.0 feet (MSL). The purpose of this outlet is pond drainage, and it is normally closed.

SECTION 2 - ENGINEERING DATA

2.1 Design Data

Among other design data available from the Soil Conservation Service are hydrologic and hydraulic computations, structural computations, and a geological report. This information was used extensively in the computations presented in Section 5 and Appendix D of this report.

2.2 Construction Data

"As built" plans are available for this dam and show good agreement with the design plans and the visual inspection.

2.3 Operational Data

No operational data is available as the dam is self-regulating.

2.4 Evaluation of Data

(a) Availability

Sufficient data is available to permit an evaluation of the dam when combined with findings of the visual inspection.

(b) Adequacy

There is sufficient design and construction data to permit an assessment of dam safety when combined with the visual inspection, past performance, and sound engineering judgment.

(c) Validity

Since the observations of the inspection team generally confirm the available data, a satisfactory evaluation for validity is indicated.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

(a) General

The Souhegan River Watershed Dam No. 10A is in GOOD condition at the present time.

(b) Dam

1) Earth Embankment (See photos #3, #4, and #8)

Some debris was found on the upstream slope of the embankment and tire ruts 4 to 6 inches deep in the crest of the embankment.

The toe drains were functioning with the left toe drain discharging approximately two gallons per minute and the right toe drain discharging approximately five gallons per minute. The discharge is clear.

2) Emergency Spillways (See Photos #1 and #2)

The emergency spillways are in good condition. There are wet spots in the channel but these are caused by natural groundwater or ponded runoff.

(c) Appurtenant Structure

1) Drop Inlet Service Spillway Structure (See photos #5 and #6)

This structure was observed from the embankment since access to the structure was not possible. The exterior service ladder could not be reached at normal pool elevation (see photos).

The structure is in good condition with the exception of the mortar rubbed surface finish which has worn away from moisture intrusion. There is no evidence of spalling, cracking, or efflorescence.

The sluice gate bench stand is in good condition. The hand wheel has been removed from the site to prevent unauthorized use. The low stage trash racks are in good condition. The high stage trash racks show minor corrosion of the end hardware supporting the racks.

2) Pond Drain Inlet Pipe

At the time of inspection the 24 inch pond drain inlet pipe was completely submerged and could not be observed.

3) Outlet Conduit (See photo =7)

The downstream end of this conduit is in fair condition. The downstream end of the outlet conduit shows random longitudinal surface cracks and efflorescence over the top of the pipe barrel. The exterior encasement has eroded at the invert over a distance of one foot and a depth of 2 inches. There is no evidence of settlement or displacement of the conduit. The cutoff wall which supports the end of the pipe is completely buried.

(d) Reservoir Area

The shore of the reservoir is generally shallow sloping woodland. It appears stable and in good condition.

(e) Downstream Channel

The downstream channel is narrow and leads to a natural waterfall. It appears stable and in good condition.

3.2 Evaluation

The dam is generally in good condition. The outlet conduit is in fair condition. The potential problems noted during the visual inspection are listed below.

a) Tire ruts in the crest of the embankment.

b) Debris in the approach channel to the right emergency spillway.

c) The ladder to the riser structure is too short to allow access at normal reservoir levels.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

No written operational procedures exist for this dam. The dam is self regulating.

4.2 Maintenance of Dam

An annual inspection is made jointly by the New Hampshire Water Resources Board and the Soil Conservation Service. Recommendations resulting from this inspection are implemented by the NHWRB.

4.3 Maintenance of Operating Facilities

Operation of the sluice gate for the pond drain inlet is checked approximately once every four or five years by NHWRB.

4.4 Description of Warning System in Effect

There is no warning system in effect.

4.5 Evaluation

The established operational procedures for this dam are generally satisfactory. Additional emphasis on routine maintenance will assist the owners in assuring the long-term safety of the dam. A formal, written downstream emergency warning system should be developed for this dam.

SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 Evaluation of Features

(a) General

Souhegan River Watershed Dam No. 10A is a Soil Conservation Service (SCS) flood control dam on Mill Brook in Wilton, New Hampshire. The dam is about one mile upstream of the village of Davisville, and 4.5 miles upstream of Wilton, New Hampshire. The upstream drainage area consists of 6.4 square miles of mountainous topography.

The dam is a 951 foot long earthen embankment with two grass-lined emergency spillways, 220 feet and 110 feet wide, respectively. The principal spillway consists of three orifices located on a concrete riser in the reservoir. Flow from the orifices proceeds under the dam through a reinforced concrete pipe.

(b) Design Data

The elevation of the low stage inlet was determined by the 50 year sedimentation level of the watershed. The high stage inlet was set to allow storage of the four year, six hour storm without water passing over the high stage inlet. The emergency spillway crest was set to allow storage of the 100 year storm and the top of dam was determined based on the Probable Maximum Flood.

The data sources available for Souhegan River Watershed Dam No. 10A include the Soil Conservation Service's (SCS) "Hydrology and Hydraulics" Design Calculations. These calculations include Storage-Elevation and Stage Discharge curves for the dam, and the routing of storms of various magnitudes through the reservoir. These calculations are dated 1965 and 1966.

Also available are SCS "Maintenance Checklist" reports on dam inspections dated June 2, 1977 and June 15, 1978.

The Soil Conservation Service Design plans, dated 1966, are also available for this dam.

(c) Experience Data

No records of flow or stage are known to be available for Souhegan River Watershed Dam No. 10A. There is a USGS gauge (Number 01093800) on Mill Brook upstream of the dam. The drainage area at the gauge is 3.6 square miles, compared to 6.4 square miles at the dam. In fourteen years of record, the peak recorded discharge at the gauge is 336 cfs. Transposed using drainage area relationships, this is equivalent to 520 cfs at the dam.

(d) Visual Observations

Souhegan River Watershed Dam No. 10A is a flood control structure on Mill Brook, a tributary of Stony Brook, which is a tributary of the Souhegan River. The dam is about one mile upstream of the village of Davisville. The dam consists of a 951 foot long earthen embankment with a crest elevation of 852 feet MSL.

There are two grass-lined earth emergency spillway channels, 220 feet and 110 feet wide, respectively, with their crests at 845 feet MSL, and with 2:1 and 4:1 side-slopes. The principal spillway consists of a concrete riser structure in the reservoir with three orifices. The flow from these three orifices combines in the riser and flows under the da- through a 30 inch reinforced concrete pipe 288.3 feet long.

The first hazard area downstream of the dam is the village of Davisville, about one mile downstream. Davisville consists of about three residences and a mill located on a small pond created by a dam on Mill Brook. The houses and mill are about ten feet above the streambed of Mill Brook.

The next hazard area, 2,000 feet downstream of Davisville, is a pair of houses 13 to 14 feet above the streambed. Mill Brook then flattens out considerably and meanders through a broad flood plain for about 7,000 feet, before entering Old Wilton Reservoir. There are two houses at the downstream end of this reach, 15 to 20 feet above the streambed.

Old Wilton Reservoir is a run-of-the-river dam, and does not provide a great deal of storage. Beginning just upstream of this dam, and continuing for about 3,400 feet downstream, Mill Brook steepens again and flows between steep banks. The brook's valley widens out about 300 feet upstream of the confluence of Mill and Stony Brooks. A trailer 8 feet above the streambed and a house 15 feet above the streambed are located in this reach.

The combined flows of Mill and Stony Brook continue downstream as Stony Brook about 6,000 feet to the town of Wilton. The brook parallels New Hampshire Highway 31 and is crossed by a Boston and Maine Railroad trestle in this reach.

Just outside of Wilton there is a group of about ten houses, an apartment, and a laundry between New Hampshire Highway 31 and Stony Brook. The ground floors of these structures range from 7 to 18 feet above the streambed. The gradient of Stony Brook flattens out in this reach, and in the middle of the town of Wilton flows over Abbott Memorial Trust Dam and joins the Souhegan River.

The Souhegan River flows through Wilton, and has 5 to 10 residences and industrial buildings on its banks there. Below Wilton the Souhegan runs through about a 5 mile reach with a wide flood plain before reaching Milford, New Hampshire.

(e) Test Flood Analysis

The hydrologic conditions of interest in this Phase I investigation are those required to assess the dam's overtopping potential and its ability to safely allow an appropriately large flood to pass. This requires using the discharge and storage characteristics of the structure to evaluate the impact of an appropriately sized Test Flood. The original hydraulic and hydrologic design calculations of the SCS are available for this dam.

Guidelines for establishing a recommended Test Flood based on the size and hazard classification of a dam are specified in the "Recommended Guidelines" of the Corps of Engineers. The impoundment of between 1,000 and 50,000 acre feet and the height of less than 100 feet classify this dam as an INTERMEDIATE structure.

The appropriate hazard classification for this dam is HIGH because of the significant economic losses and high potential for loss of life downstream in the event of dam failure. As shown in the Dam Failure Analysis section, the increase in flooding caused by failure would pose a threat to property and to lives in the village of Davisville, in the town of Wilton, and at other locations between the two. Other impacts of dam failure include possible damage to several well-traveled roads, to the Boston and Maine Railroad, and to several small dams on Mill Pond and Stony Brook (see Dam Failure Analysis section).

As shown in Table 3 of the Corps of Engineers' "Recommended Guidelines," the appropriate Test Flood for a dam classified as INTERMEDIATE in size with a HIGH hazard potential would be the Probable Maximum Flood (PMF).

As part of their hydraulic and hydrologic design calculations for the dam, the SCS created a "Freeboard Hydrograph" (approximately equivalent to the PMF) and routed it through the reservoir using a storage router. The peak inflow is 11,747 cfs, which is 1,835 csm on a 6.4 square mile drainage area. This compares to the 2,140 csm given on the Corps of Engineers' "Maximum Probable Peak Flow Rates" curve assuming mountainous topography.

The COE number, resulting in a peak inflow of 13,700 cfs, is slightly more conservative and is therefore selected as the test flood for this dam. In routing the Freeboard Hydrograph, the SCS used 831.5 feet MSL (17.5 feet above normal pool) as a reasonable starting point. This elevation was selected because it is reached after five days drawdown from the Emergency Spillway crest.

Using the COE standard methodology to determine the peak outflow after reduction by storage with 831.5 feet MSL as the starting elevation, the peak outflow is 9,500 cfs. This yields a water surface elevation of 850.5 feet MSL, 1.5 feet below the dam crest, and 36.5 feet above normal pool.

(f) Dam Failure Analysis

The peak outflow that would result from the failure of Souhegan River Watershed Dam No. 10A is estimated using the procedure suggested in the Corps of Engineers New England Division's April 1978 "Rule of Thumb Guidelines for Estimating Downstream Dam Failure Hydrographs," as clarified in a December 7, 1978 meeting at the Corps' Waltham office. Normally this procedure is carried out with dam failure assumed to occur when the water surface reaches the top of the dam. In this case, however, the outflow of 14,700 cfs with the water surface at the top of the dam (852 feet MSL) is greater than the Probable Maximum Flood (PMF) routed outflow at the dam. Also, this outflow would create serious flooding downstream prior to dam failure. As a result, dam failure would cause only a small incremental increase to flood damage in this situation. Failure is therefore assumed to occur with the water surface at the SCS Design High water of 849 feet MSL, 3.0 feet below the top of the dam.

The discharge to Mill Brook just prior to failure at the elevation is given by the Stage-Discharge curve developed in Appendix D as 5300 cfs. The tailwater prior to failure at this discharge would be about 6.6 feet of flow in the channel downstream of the dam.

For an assumed breach width equal to 40 percent of the dam width at the half-height, the gap in the embankment due to failure would be 145 feet. The resulting increase in flow would be 84,600 cfs, or a total flow of about 89,900 cfs. This would increase the tailwater elevation 13 feet.

The first damage center impacted by dam failure flow would be the village of Davisville, about one mile downstream of the dam. Davisville includes a mill and about 3 dwellings, built around a small pond on Mill Brook. At the flows considered here, this dam would not be likely to survive. The buildings in Davisville are about 10 feet above the streambed. The pre-failure outflow of 5,300 cfs would create a stage about at the first floor level of the houses. The attenuated flow after failure of 76,500 cfs would increase the stage to about 20 feet, creating some 10 feet of flooding. This would cause serious damage and present a major threat of loss of life at the village.

The next damage center is a pair of houses 2,000 feet downstream of Davisville. These houses are 13 to 14 feet above the streambed, and would not be affected by the pre-failure outflow of5,300 cfs. The attenuated peak failure flow of 67,000 cfs would cause a stage about 17 feet above the streambed, creating 3 to 4 feet of flooding at the houses.

The next reach of Mill Brook is about 7,000 feet broad flood plain down to Old Wilton Reservoir. This reach offers a great deal of temporary storage and would reduce the peak outflow to 39,100 cfs. There are no dwellings that would be affected by the dam failure outflow in this reach. Old Wilton Reservoir is a run-of-the-river pool, and its dam would be severely overtopped by flows of this magnitude. The dam would not reduce flows significantly and would probably be damaged or destroyed by the dam failure outflow.

Downstream of Old Wilton Reservoir Mill Brook joins Stockwell Brook and the combined flow proceeds 3,700 feet into Stony Brook. The only dwellings in this reach are a trailer and a house (under construction) near the confluence with Stony Brook. The trailer is about 8 feet above the streambed and the house about 15. The pre-failure flow of 6,300 cfs (including an assumed inflow of 1,000 cfs from Stockwell Brook) would cause about 1.5 feet of flooding at the trailer. The peak dam failure outflow of 38,000 cfs would cause a stage of 18 feet, creating 10 feet of flooding at the trailer and 3 feet at the house. This sudden increase could present a threat of loss of life in this area.

Stony Brook parallels U.S. Highway 31 for about 6,000 feet to the town of Wilton. The Boston and Maine Railroad crosses the creek on a high trestle in this reach, with no other development.

Just outside of Wilton there are a number of houses along the banks of Stony Brook. There are 9 houses 7 to 12 feet above the streambed, and 2 houses about 18 feet above the streambed. There is also an apartment building 12 feet above the streambed and a laundry about 10 feet up. Highway 31 parallels the brook about 10 feet above the streambed, and there are numerous dwellings and commercial establishments on the other side of the highway about 20 to 25 feet above the streambed.

The estimated pre-failure flow of 8,300 cfs (including 2,000 cfs of inflow from Stony Brook) would create a stage of 14 feet in this reach, which would cause serious flooding problems at the houses and businesses along the brook. The dam failure outflow of 35,700 cfs would yield a stage of about 25 feet on Stony Brook, which would cause extreme and dangerous flooding in this reach.

Downstream of the residences and still in the town of Wilton, Stony Brook passes over Abbot Memorial Trust Dam and flows into the Souhegan River. The flow of about 35,000 cfs would create serious flooding on the Souhegan in Wilton, along which a few (5 to 10) houses and businesses are located. Downstream of Wilton the Souhegan flows through about 5 miles of broad flood plain before reaching the town of Milford. It is expected that the dam failure outflow would be essentially attenuated in this reach.

In addition to the impacts on residences discussed above, the dam failure outflow would be likely to damage or destroy 5 bridges across minor roads, a couple of small dams, the Boston and Maine Railroad trestle across Stony Brook, and New Hampshire Highway 31.

The following chart summarizes the downstream impacts of the failure of Souhegan River Watershed Dam No. 10A

DOWNSTREAM IMPACTS OF DAM FAILURE

Location (Map, p. D-9)	Location	Number of Dwellings	Level Above Streambed (ft.)	Flow and Stage Before Failure	Flow and Stage After Failure	Comments
	Tailwater	-	-	5,300 cfs 7 ft.	89,000 cfs 19 ft.	
1	Davisville	3 + 1 Mill	10'+	5,300 cfs 10-11 ft.	76,500 cfs 21 ft.	Danger of loss of life.
	Houses 2000' downstream of Davisville	2	13-14	5,300 cfs 10 ft.	67,000 cfs 17 ft.	
2	Old Wilton Reservoir	-	-	5,300 cfs	39,100 cfs	Significant attenuation in flood plain. Old Wilton Reservoir damaged or destroyed.
3	Confluence with Stony Brook	2	8 and 15	6,300 cfs 10 ft.	38,000 cfs 18 ft.	Danger of loss of life.
4	Houses in Wilton	9 2 apartment	7-12 18 12	8,300 cfs ft.	35,700 cfs ft.	Devastating flooding. High potential for loss of life.
5	Confluence with Souhegan	-	-	5,300 cfs	35,700 cfs	
	Souhegan	5-10	-	5,300	35,700 cfs±	Flooding in Wilton. Probably attenuated in 5 miles to Milford.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

(a) Visual Observations

There has been no significant displacement or distress which would warrant the preparation of structural stability calculations.

(b) Design and Construction Data

1) Embankment

No records of an embankment slope stability assessment are available for this dam.

2) Appurtenant Structures

A review of structural calculations for the design of the drop inlet service spillway structure and the outlet conduit (principal spillway) revealed that these structures have been designed on the basis of sound engineering practice.

(c) Operating Records

There are no known operating records for this dam.

(d) Post Construction Changes

There have been no known construction changes since the dam was completed in 1965.

(e) Seismic Stability

The dam is located in seismic zone No. 2 and, in accordance with the recommended Phase I guidelines, does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

(a) Condition

The dam and its appurtenances are generally in good condition at the present time with the exception of the outlet conduit which is in fair condition.

(b) Adequacy of Information

There is sufficient design and construction data to permit an assessment of dam safety when combined with the visual inspection, past performance, and sound engineering judgment.

(c) Urgency

The recommendations and remedial measures described herein should be implemented by the owner within two years of receipt of this phase I Inspection Report.

(d) Need for Additional Investigations

None

7.2 Recommendations

No conditions were observed which warrant further investigation.

7.3 Remedial Measures

It is recommended that the owner institute the following remedial measures.

1) Check the operability of the pond drain inlet gate as part of the annual inspection procedure.

2) Develop a formal written downstream emergency flood warning system.

3) Maintain the program of annual technical inspections.

4) Provide a means of access to the riser structure during periods of normal flow with a ladder extention or other suitable means. This need not be on site, but should be available for inspection of the riser.

5) Implement and intensify a program of diligent and periodic maintenance including, but not limited to: mowing of slopes; backfilling tire ruts with suitable, well-tamped soil; and clearing debris from slopes and trash racks.

6) Monitor the cracking of the outlet end of the primary conduit on an annual basis.

7.4 Alternatives

There are no meaningful alternatives to the above recommendations.

APPENDIX A

VISUAL INSPECTION CHECKLIST

INSPECTION TEAM ORGANIZATION

Date: May 1, 1979

Project: NH 00264
SOUHEGAN RIVER WATERSHED PROJECT FLOODWATER
RETARDING DAM NO. 10A
Wilton, New Hampshire
NHWRB 254.33

Weather: Overcast, drizzle, cool

INSPECTION TEAM

Nicholas A. Campagna	Goldberg, Zoino, Dunnicliff & Assoc. (GZD)	Team Captain
William S. Zoino	GZD	Soils
M. Daniel Gordon	GZD	Soils
Jeffrey M. Hardin	GZD	Soils
Paul Razgha	Andrew Christo Engineers (ACE)	Structures
Carl Razgha	ACE	Structures
Tom Gooch	Resource Analysis, Inc. (RAI)	Hydrology
Robert Fitzgerald	RAI	Hydrology

Owner's Representative Present

Gary Kerr - New Hampshire Water Resources Board

CHECK LISTS FOR VISUAL INSPECTION

AREA EVALUATED	BY	CONDITION & REMARKS
DAM EMBANKMENT		
Crest elevation	NAC	852 ft. (MSL)
Current pool elevation		814 ± ft. (MSL)
Maximum impoundment to date		Unknown
Surface cracks		None
Pavement condition		Not applicable
Movement or settlement of crest		None
Lateral Movement		None
Vertical alignment		Good
Horizontal alignment		Good
Condition at abutment and at concrete structures		Good
Indications of movement of structural items on slopes		None
Trespassing on slopes		Debris on upstream slope and emergency spillway. Tire ruts in crest.
Sloughing or erosion of slopes of abutments		None
Rock slope protection - riprap failures		No riprap - upstream slope in good condition
Unusual movement or cracking at or near toes		None
Unusual embankment or downstream seepage	NAC	None

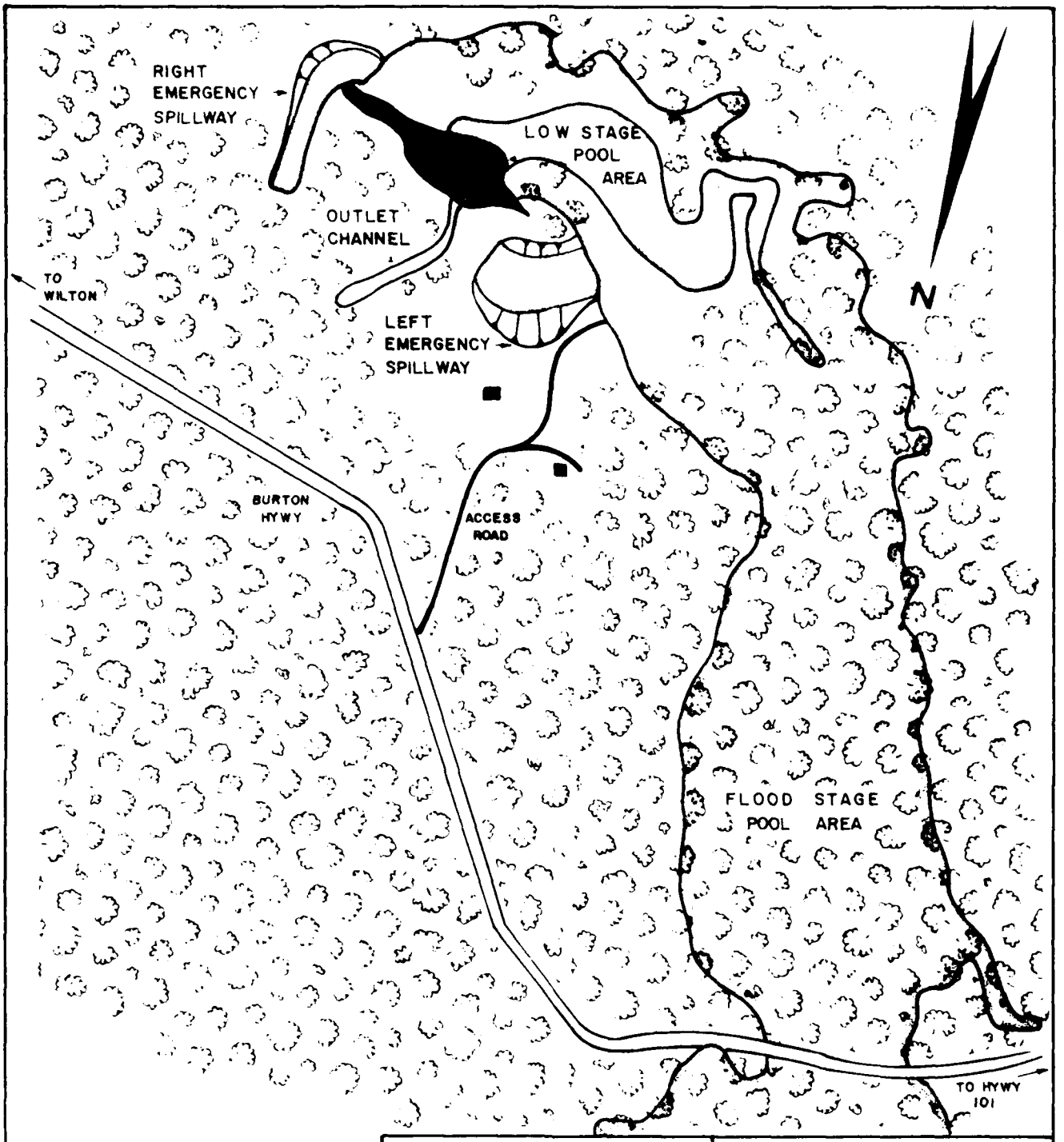
CHECK LISTS FOR VISUAL INSPECTION

AREA EVALUATED	BY	CONDITION & REMARKS
Piping or boils		None
Foundation drainage features		Functioning as below
Toe drains		Right: 5 gpm Left: 2 to 4 gpm
Instrumentation system		None
APPURTENANT STRUCTURES		
A. Drop Inlet Service Spillway		
Structure		-
Condition of concrete		Good
Spalling		None noted
Erosion		Mortar rubbed surface eroded
Cracking		None noted
Rusting or staining of concrete		None noted
Visible reinforcing		None noted
Efflorescence		None noted
Trash racks		
Upper stage trash racks		Minor rusting or galv. hardware
Lower stage trash rack		No deficiencies noted on exposed portion
Gate bench stand		No deficiencies noted

CHECK LISTS FOR VISUAL INSPECTION

AREA EVALUATED	BY	CONDITION & REMARKS
Exterior aluminum ladder	PJL	Existing ladder not accessible during normal or low flows. Ladder in good condition
B. Reservoir Discharge Conduit		Submerged, could not be observed
C. Outlet Conduit (Primary Spillway)		
Condition of pipe	PJL	Invert of outlet end eroded 6" x 2" deep x 4" high. Random longitudinal surface cracks on crown of pipe 6" long with efflorescence.

APPENDIX B



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GEOTECHNICAL CONSULTANTS
NEWTON UPPER FALLS, MASS.

U.S. ARMY ENGINEER DIV NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

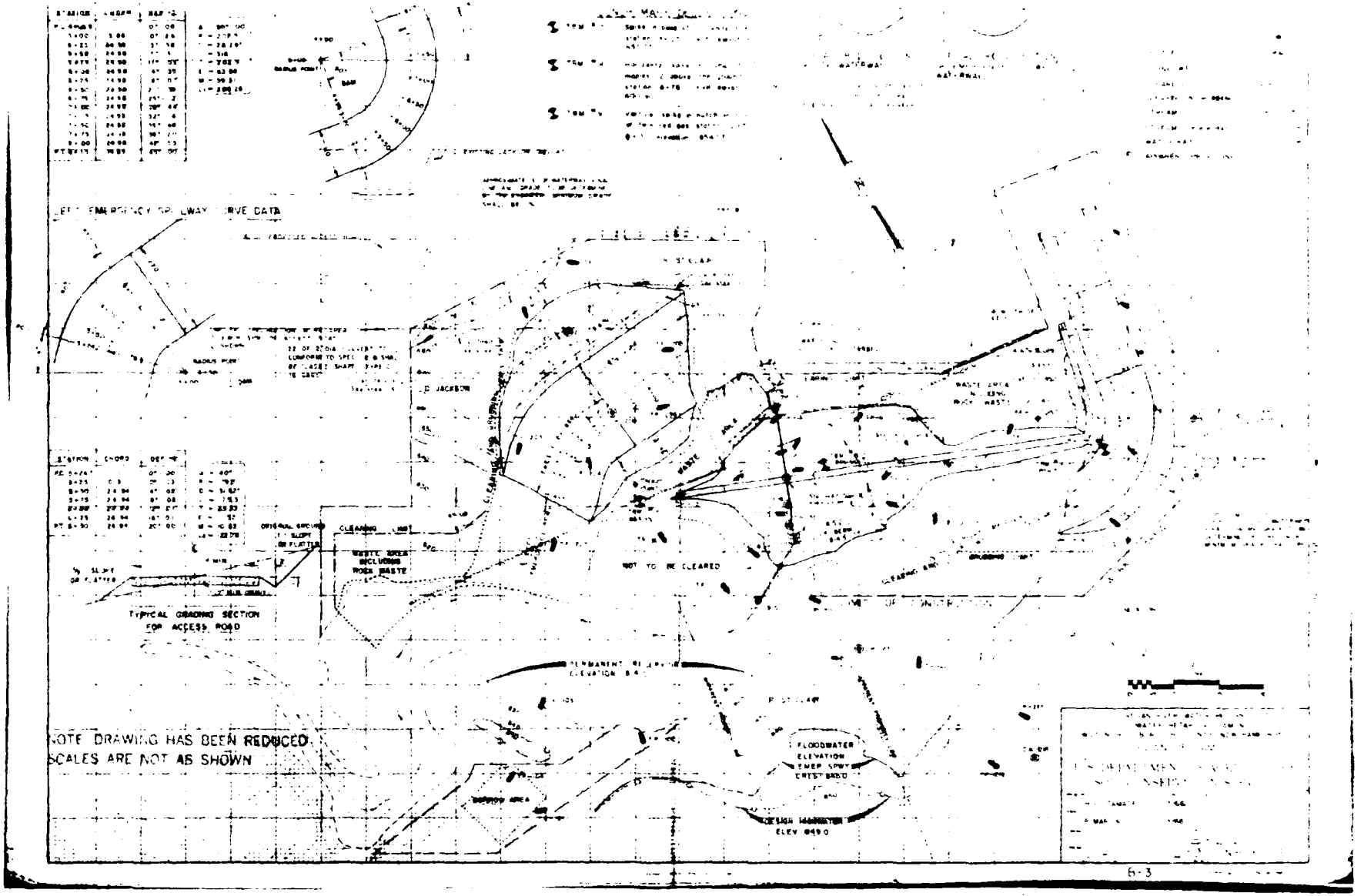
SITE PLAN

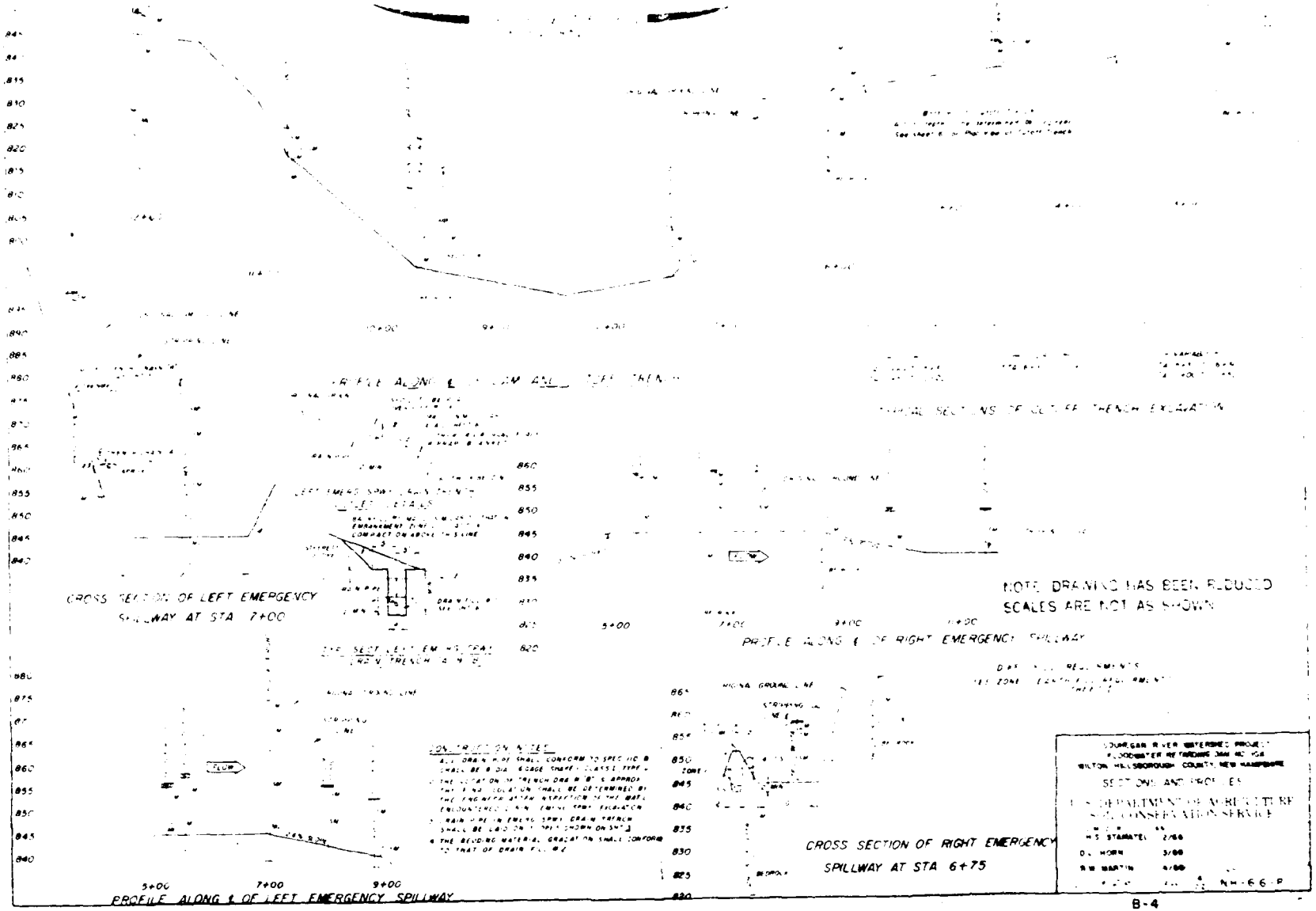
SOUHEGAN RIVER WATERSHED
DAM No. 10A

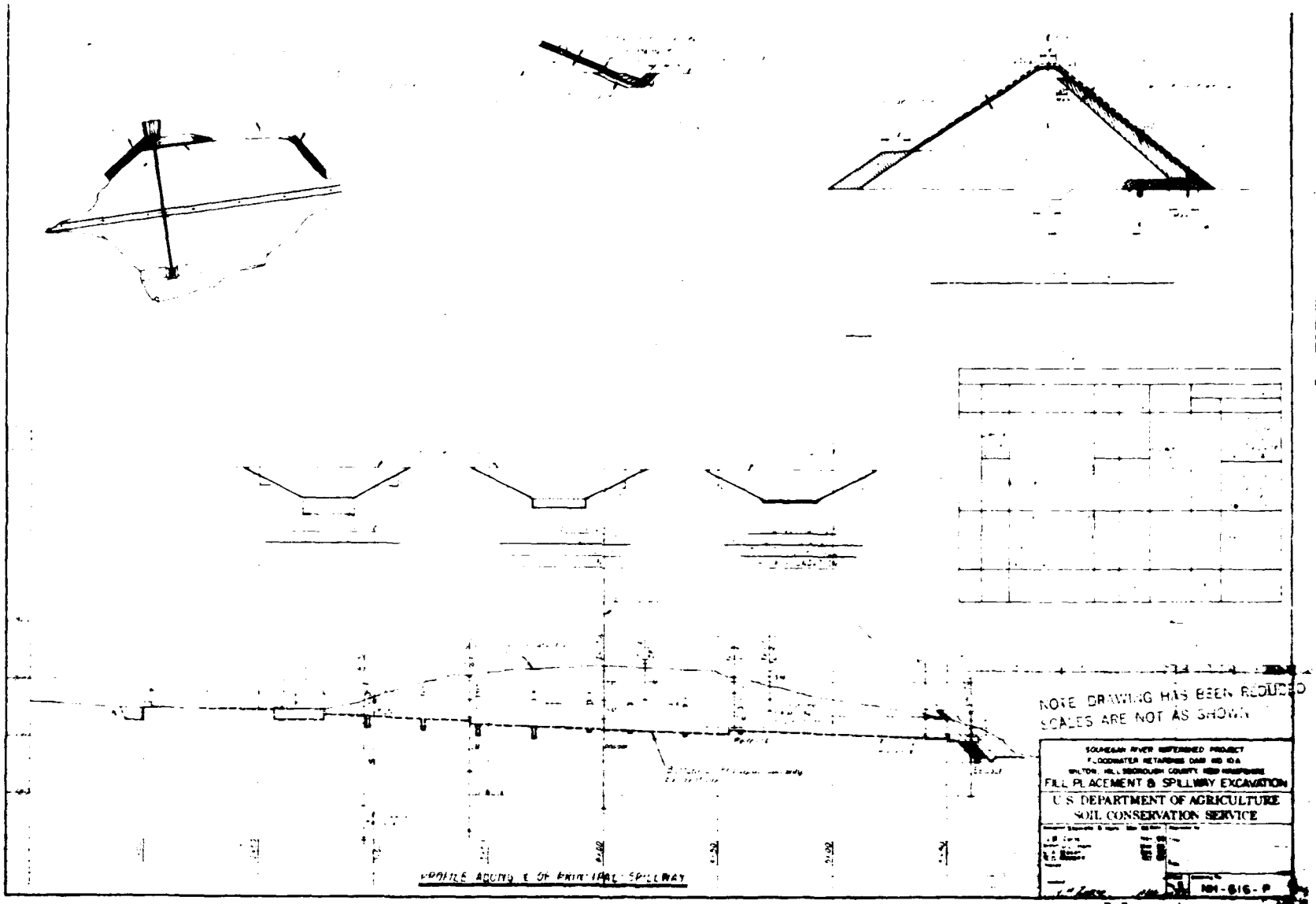
FILE No. 2327

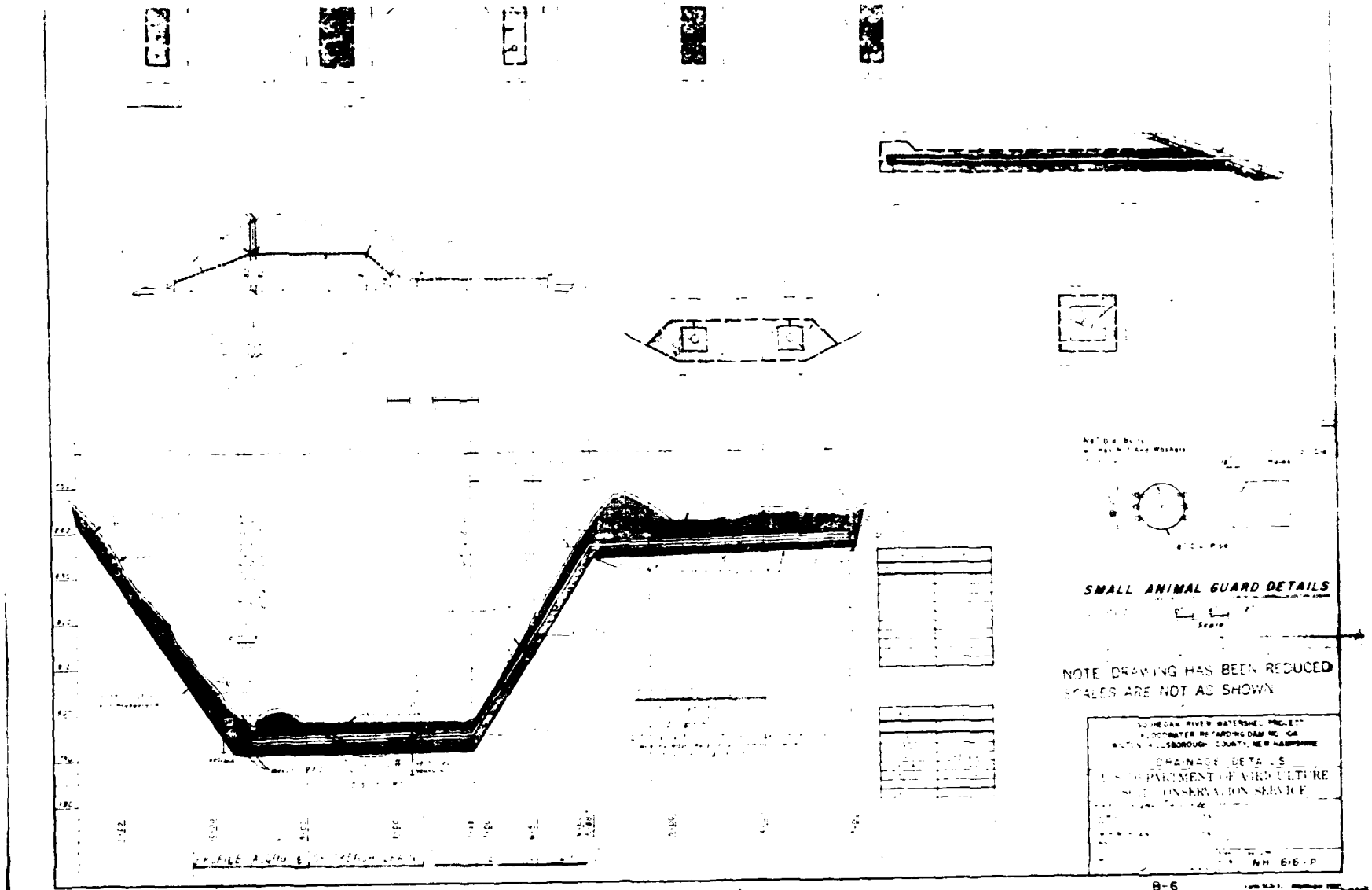
SCALE 1" 600'

DATE MAY 1979


TYPICAL GRADING SECTION FOR ACCESS ROAD
NOTE DRAWING HAS BEEN REDUCED
SCALES ARE NOT AS SHOWN







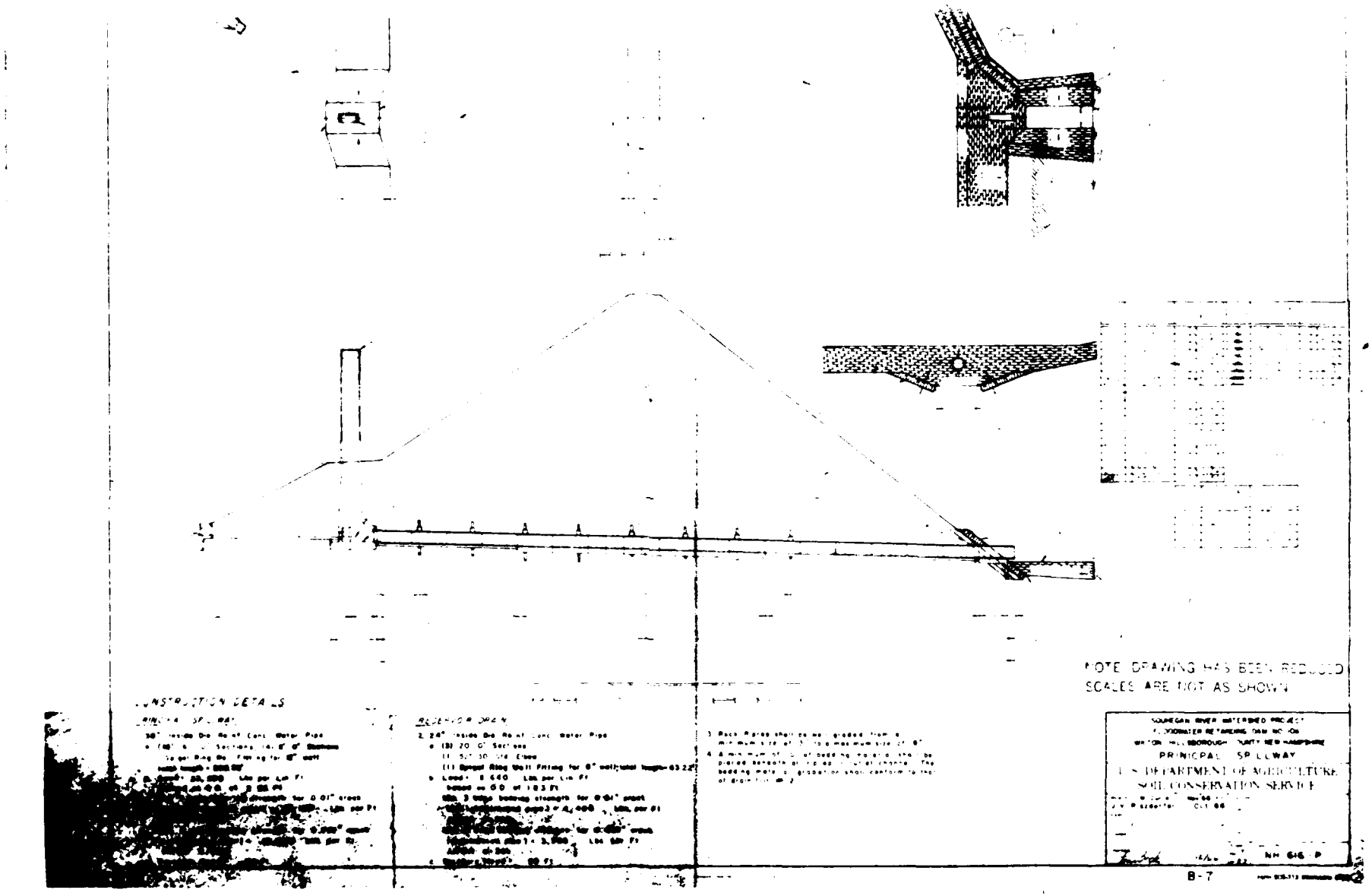
SMALL ANIMAL GUARD DETAILS

NOTE DRAWING HAS BEEN REDUCED
SCALES ARE NOT AS SHOWN

SOUHEGAN RIVER WATERSHED PROJECT
FLOODWATER RETARDING DAM NO. 6A
HILLSBOROUGH COUNTY, NEW HAMPSHIRE

DRAINAGE DETAILS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

NH 616-P



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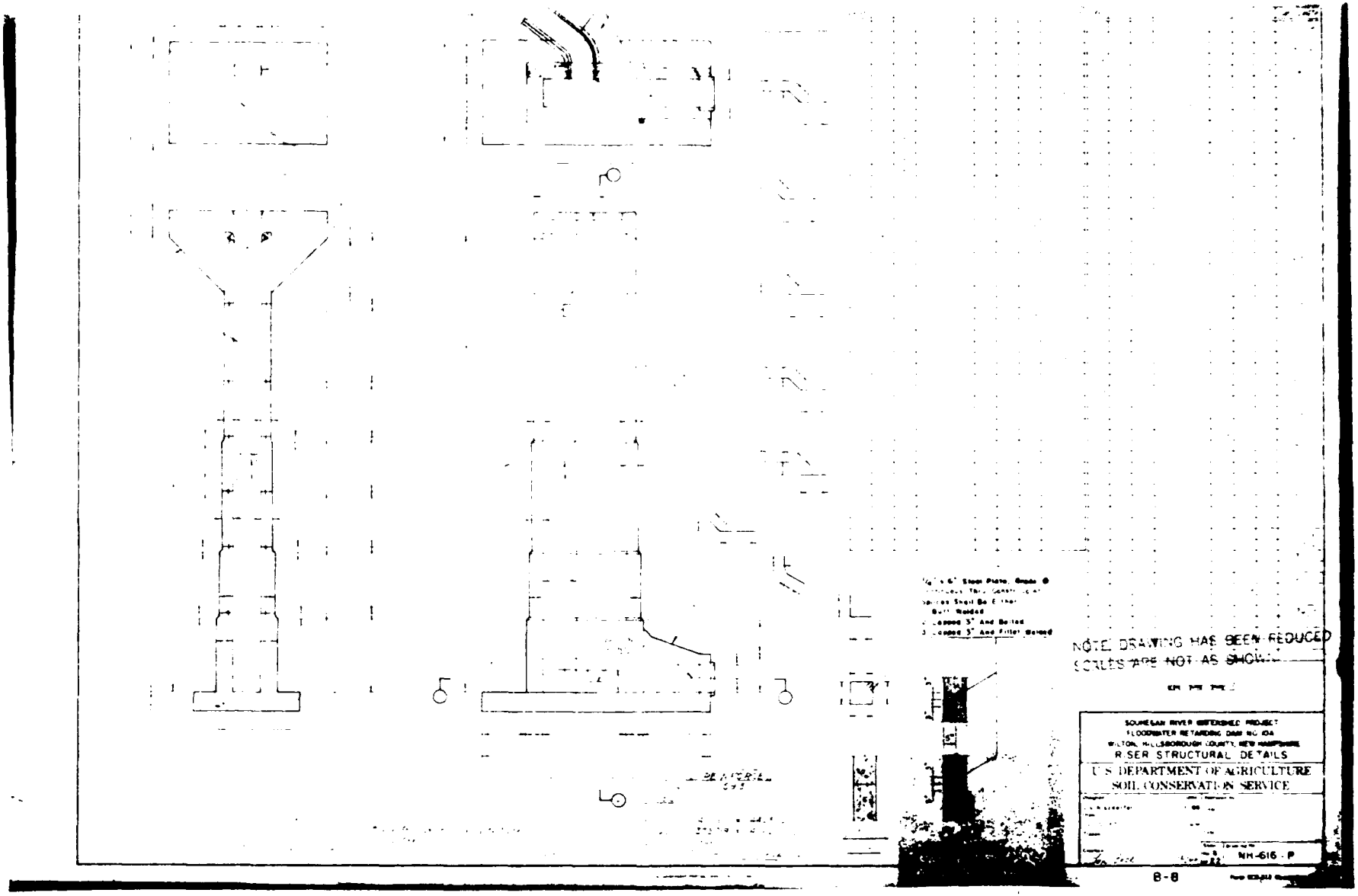
PRINCIPAL SPILLWAY
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

NH 645 P

B-7

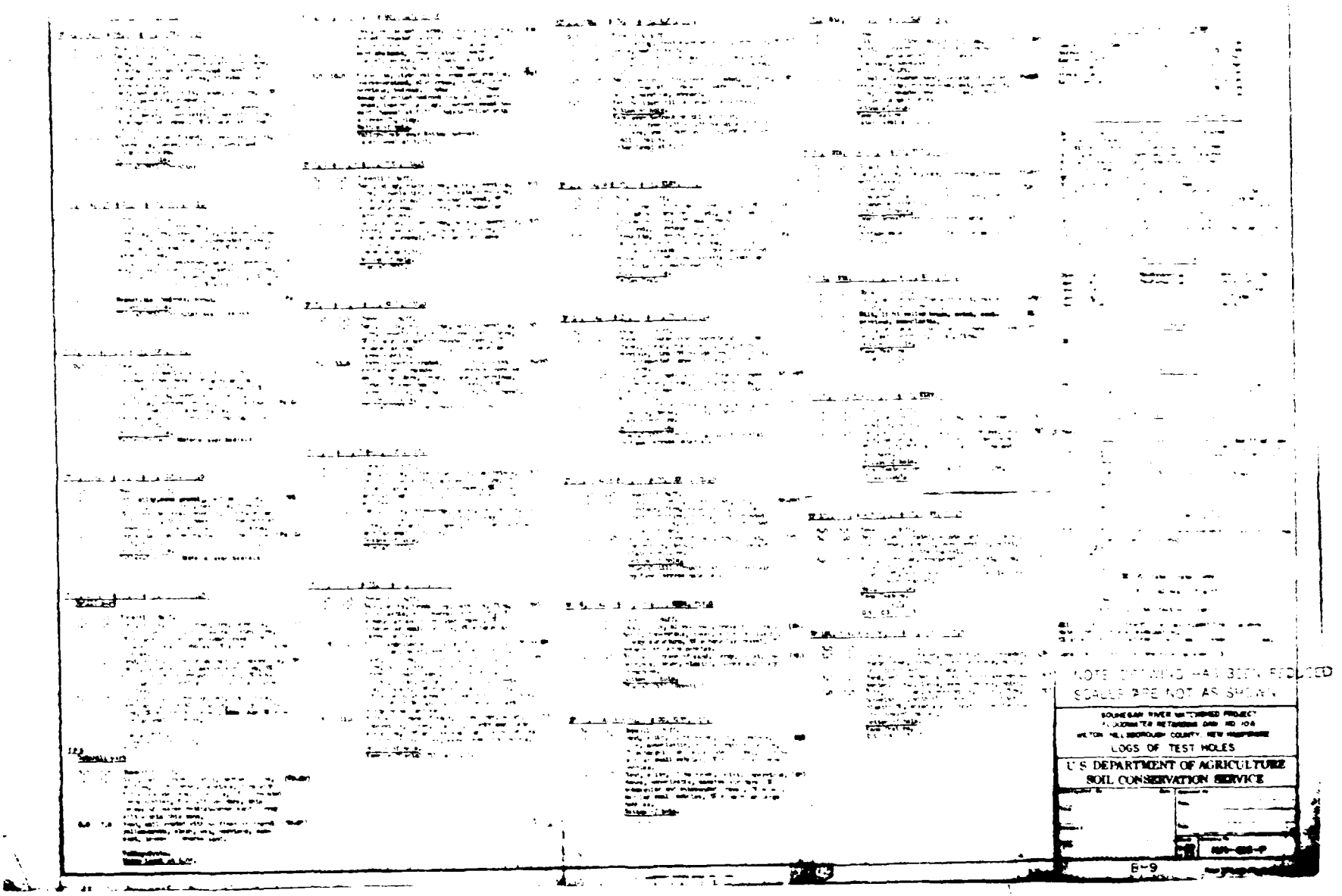


NOTE: DRAWING HAS BEEN REDUCED
SCALES ARE NOT AS SHOWN

SOUHEGAN RIVER WATERSHED PROJECT
FLOODWATER RETARDING DAM NO. 10A
WILTON, HILLSBOROUGH COUNTY, NEW HAMPSHIRE
RISER STRUCTURAL DETAILS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

NH-616-P

8-8



NOTE DRAWING HAS BEEN REDUCED
SCALES ARE NOT AS SHOWN

SOUHEGAN RIVER WATERSHED PROJECT
AMHERST, TEMPLETON, WILTON, AND MILFORD
WILTON HILLSBOROUGH COUNTY, NEW HAMPSHIRE

LOGS OF TEST HOLES

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SCS-ENG-P

E-9

The U.S.D.A. Soil Conservation Service (SCS) located in Durham, New Hampshire, maintains a file for this dam. Included in this file are:

1) SCS "Design Report" dated 1966.

2) SCS "Hydrology and Hydraulics" design calculations dated February 1966.

3) SCS structural design calculations dated December 1966.

4) SCS "Detailed Geological Investigation of Dam Sites" dated 1964.

5) SCS soil mechanics laboratory data sheets dated January 1963.

6) SCS "As Built" drawings dated 1967.

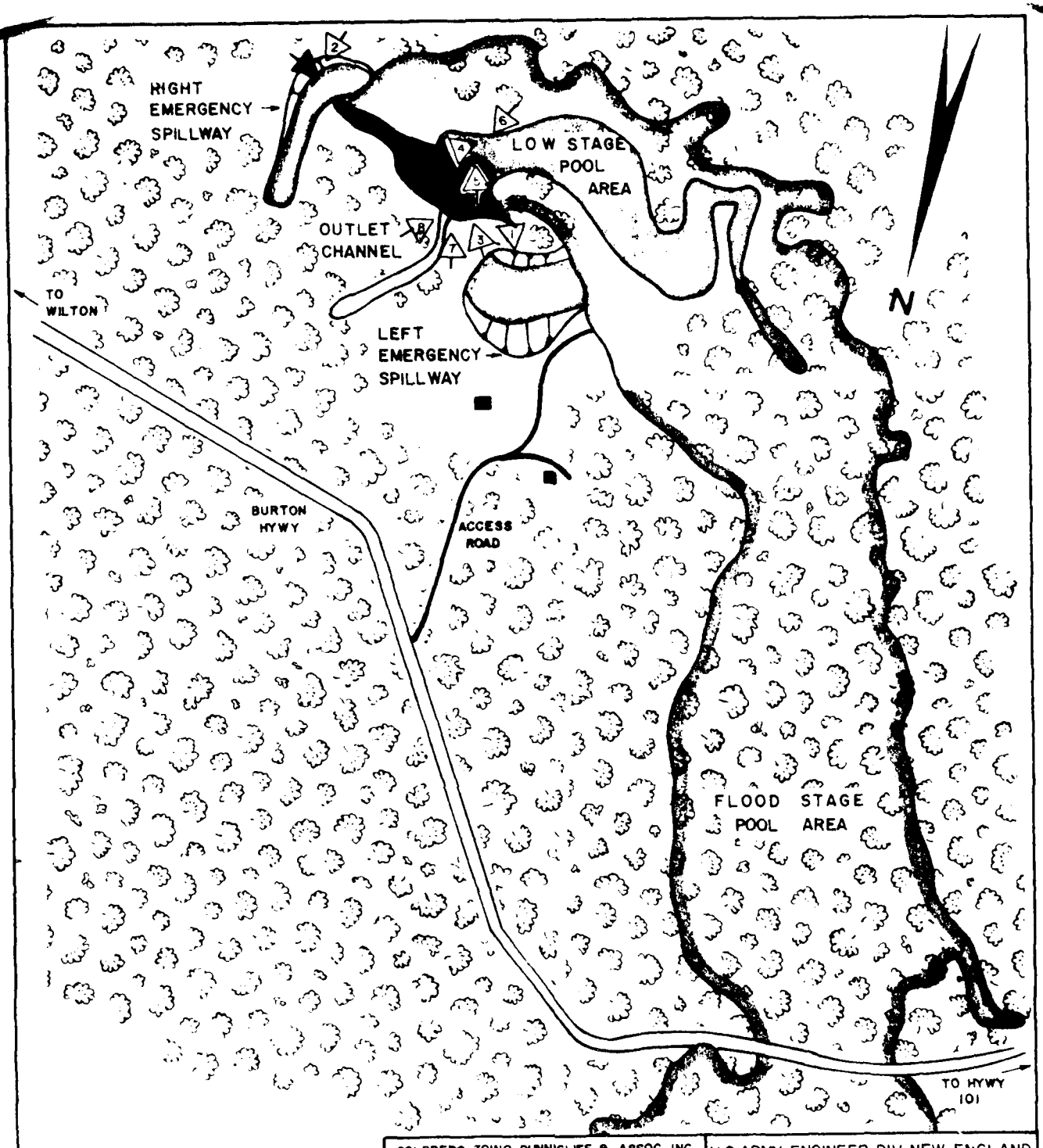
The New Hampshire Water Resources Board (NHWRB) maintains a correspondence file on this dam. Included in this file are:

1) Maintenance inspection checklists dated May 19, 1977 and June 15, 1978.

2) Memo discussing alleged damage to emergency spillway control section dated June 2, 1977.

APPENDIX C

PHOTOGRAPHS



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OVERVIEW

APPENDIX C

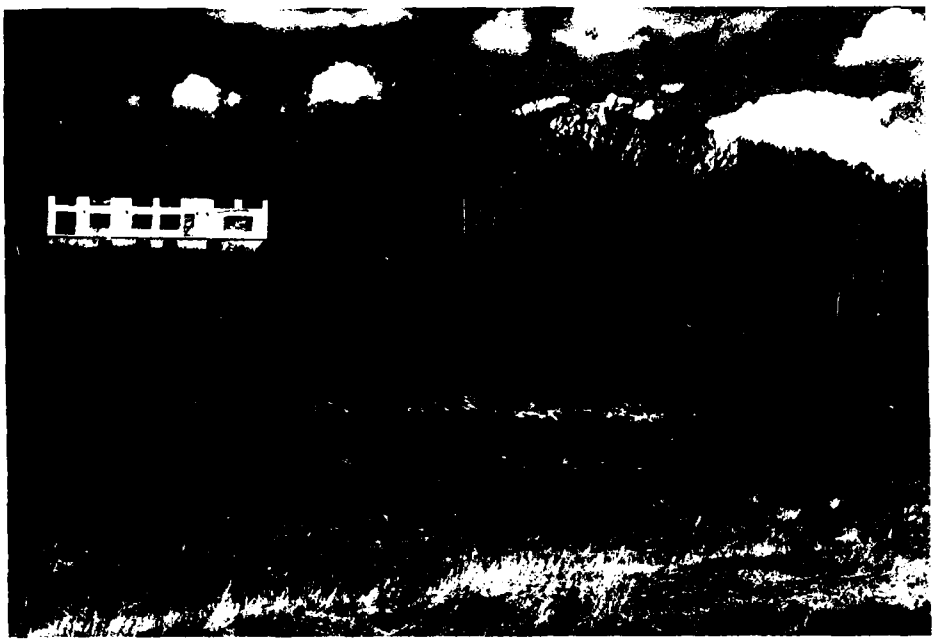
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION AND ORIENTATION OF PHOTOS

SOUHEGAN RIVER WATERSHED
DAM No. 10A
NEW HAMPSHIRE

FILE No. 2327

SCALE 1" = 600'
DATE MAY 1979

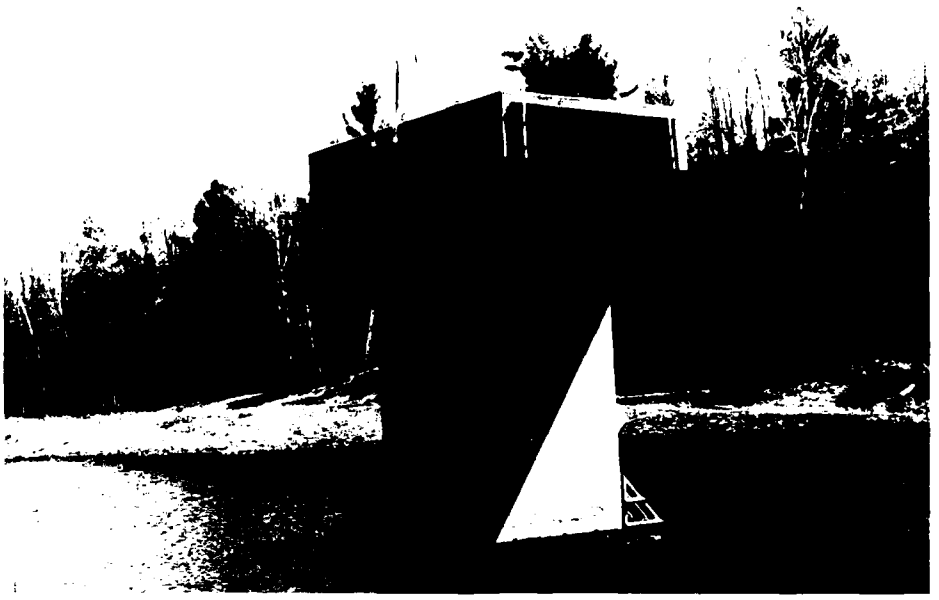


1. View of left emergency spillway channel from embankment

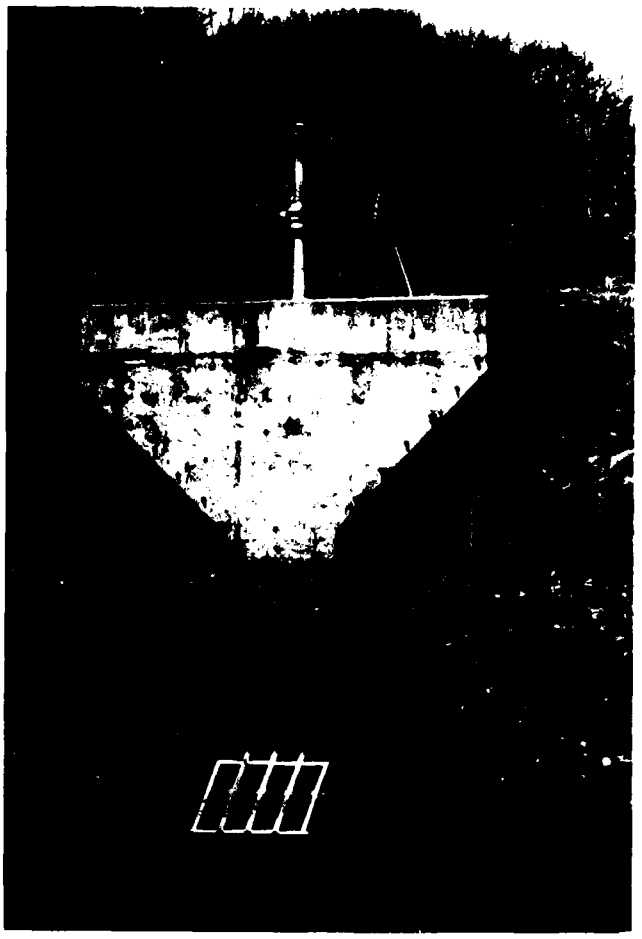
2. View of right emergency spillway channel looking downstream

3. View of downstream slope from left side

4. View of right upstream slope showing debris on the approach to the right emergency spillway



5. View of drop inlet structure showing ladder and high stage trash racks



6. View of drop inlet structure showing low stage trash racks

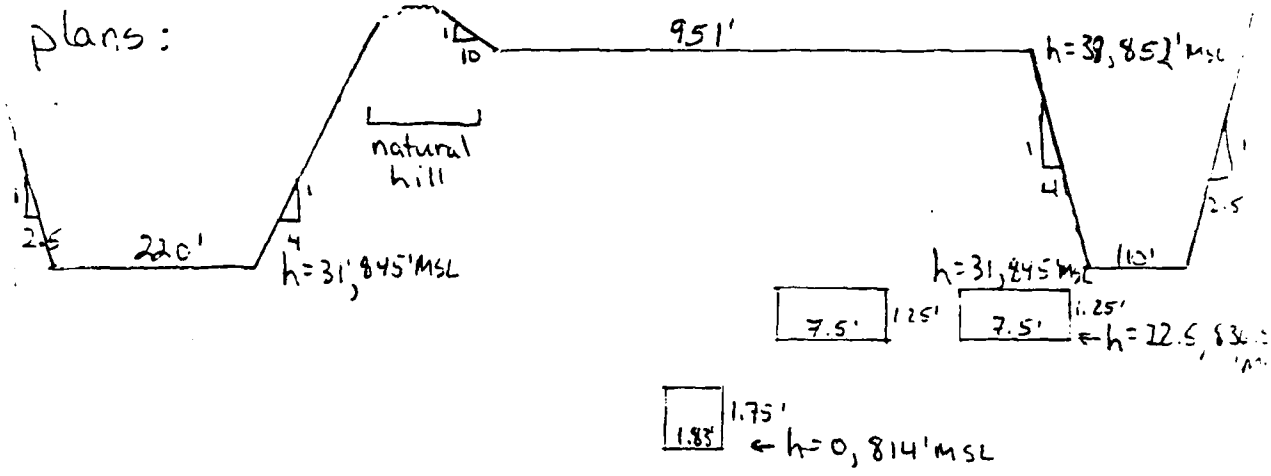
7. View of outlet pipe showing efflorescence

8. View of right toe drain outlet

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

The information used to determine this elevation of Souhegan River Watershed Dam # 10-A was determined from Field notes and SCS construction plans:



Not to scale

The 1.83' x 1.75' orifice and the two 7.5'-x 1.25' orifices are on a riser structure in the reservoir. The flows from these outlets combine and flow under the dam through a 30" reinforced concrete pipe 188.3' feet long with the upstream invert at 794.83' MSL and the downstream invert at 790.83' MSL. The flow through this pipe is the "principal spillway" flow, and is controlled by the pipe at high stages.

There is one additional source of inflow to the riser - a "pond drain inlet" which is 62.9' of 24" r.c.p. with the invert at 796' MSL. This inlet is not generally operated. Its flow combines with that from the orifices

on the riser and flows under the dam through the 30" pipe. In the stage-discharge calculations which follow, it is assumed that the pond drain inlet is closed.

The S.C.S. developed a stage-Discharge relationship for the principal and emergency spillways. The design for which this relationship was determined differs from the final design in one respect: the calculations assumed emergency spillway widths of 225' and 105', while the final design used 220' and 110'. P. 30 of the "Hydrology and Hydraulics" calculations shows flow/unit width vs. pool elevation for the two spillways. Since the values are all but identical, the change will make almost no difference in total discharge.

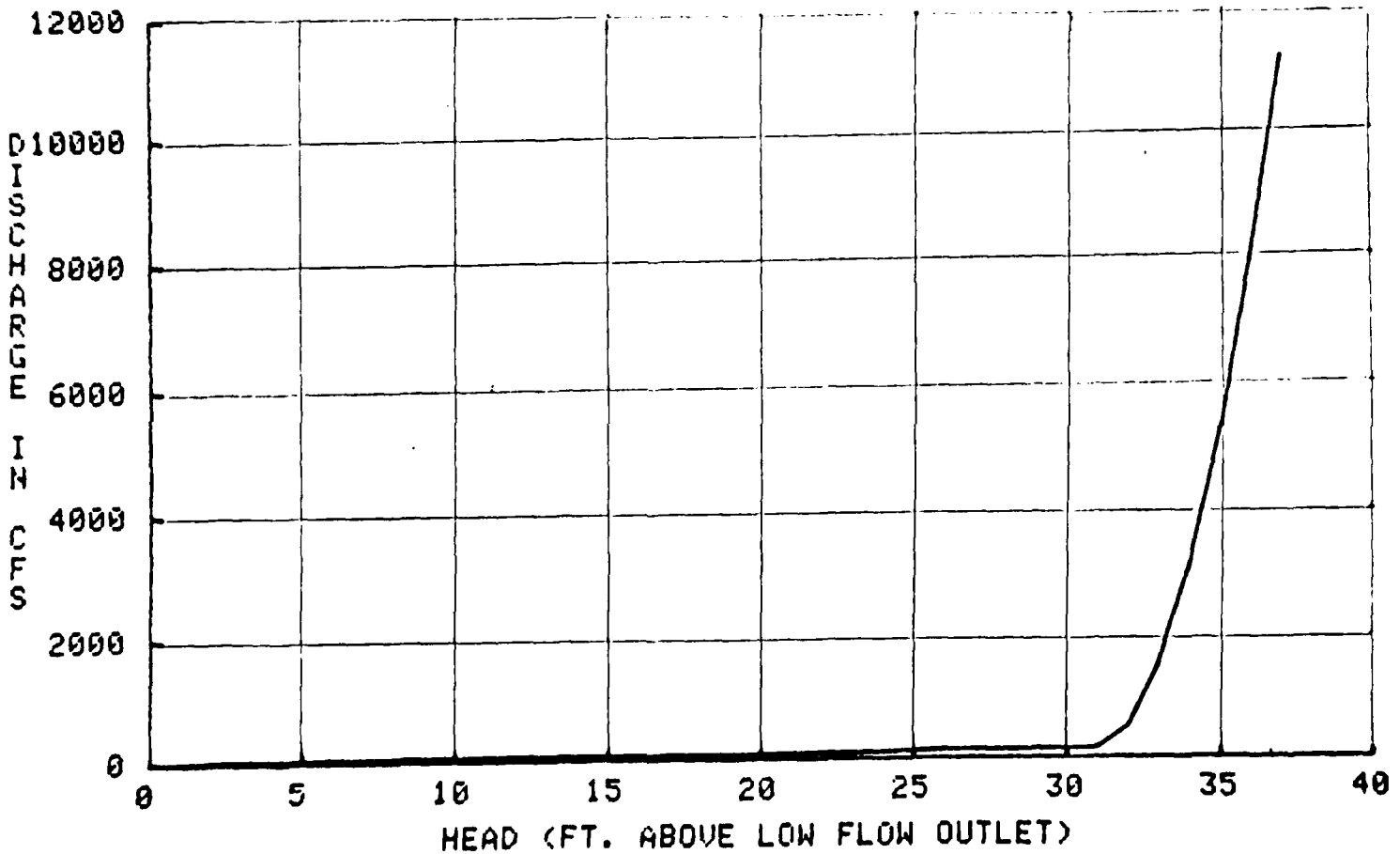
elevation (ft. MSL)	Stage (h) (Ft. above Low Flow Outlet (crest)	Principal Spillway* Outflow (cfs)	Emergency Spillway* Outflow (cfs)	Total Outflow (cfs)
814 → Low flow outlet	0	0	0	0
815	1	6	0	6
816	2	18	0	18
820	6	38	0	38
825	11	53	0	53
830	16	65	0	65
836	22	77	0	77
836.5 high flow riser crest	22.5	78	0	78
837	23	95	0	95
840	26	134	0	134
842	28	137	0	137
845 → em. spill. crest	31	141	0	141
846	32	142	375	517
847	33	143	1353	1,496
848	34	145	2963	3,108
849	35	146	5161	5,306
850	36	147	7821	7,968
851	37	148	11,003	11,151
852	38	149**	14,537**	14,686**

* Sheet 27 of SCS "Hydrology and Hydraulics" computations, dated 2/66

** Estimated

P. 4 gives a Stage-Discharge Curve for this dam.

STAGE-DISCHARGE CURVE FOR SOUHEGAN R. W. DAM # 10-A

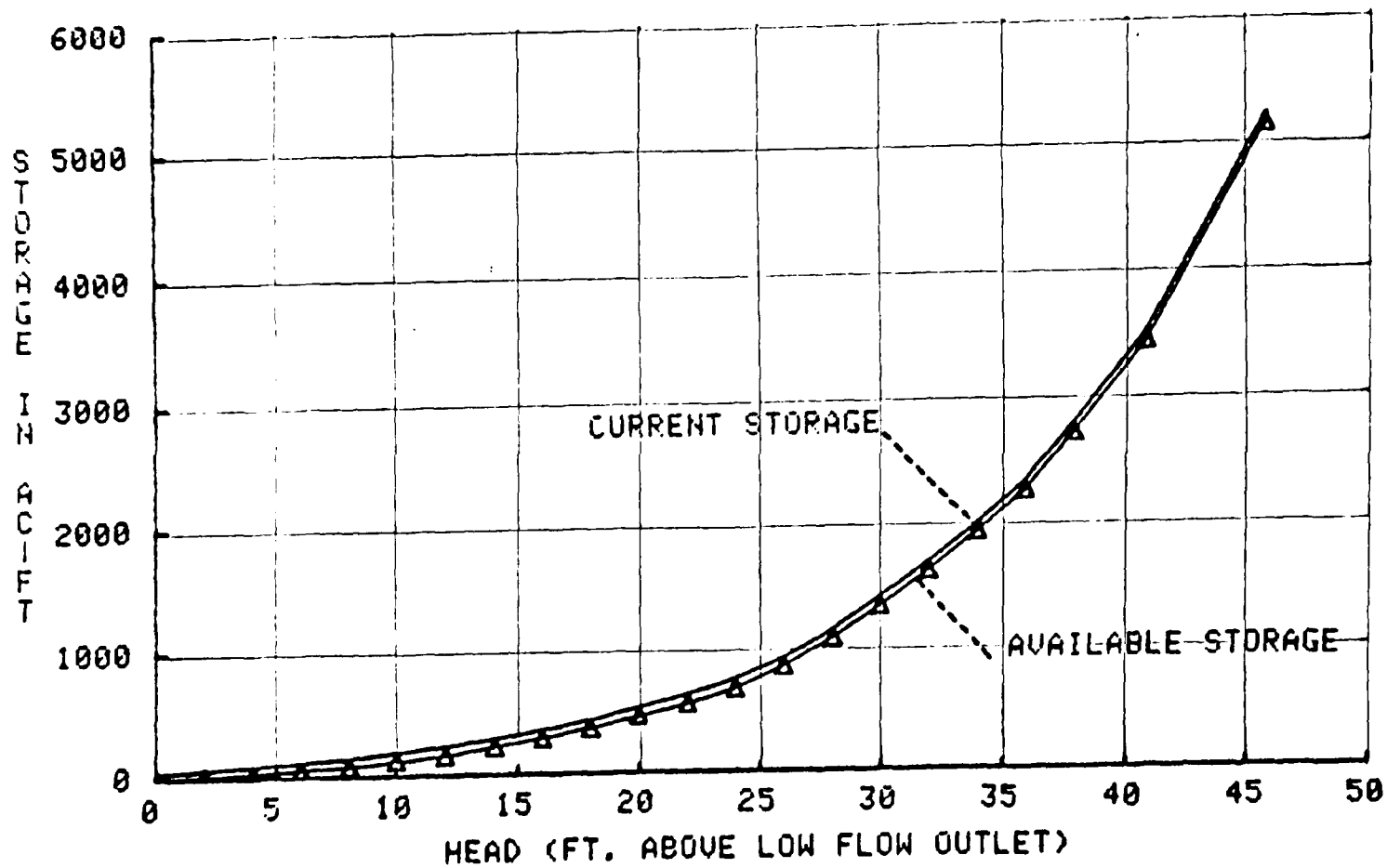


Storage-Elevation Curve

The following Storage-Elevation Curve was given in the SCS "Hydrology and Hydraulics Calculations, pp. 7-9 (2/66) and pp. 11-12 (2/66). This curve is plotted on p. 6.

Elevation (ft. msl)	Stage (h) (Ft. above Low Flow OUTLET)	Current Storage (Ac-Ft.)	Available storage (After 50 yrs.) (Ac-Ft.)
793	-21	0	0
794	-20	0	0
796	-18	.1	0
798	-16	.3	0
800	-14	1.0	0
802	-12	2.2	0
804	-10	4.4	0
806	-8	9.8	0
808	-6	13	0
810	-4	21	0
812	-2	33	0
814	0	47	0
816	2	64	10
818	4	86	27
820	6	113	48
822	8	145	75
824	10	184	114
826	12	230	160
828	14	286	217
830	16	354	284
832	18	433	363
834	20	522	453
836	22	622	552
838	24	742	672
840	26	914	844
842	28	1137	1067
840	30	1389	1319
846	32	1669	1599
848	34	1977	1907
850	36	2314	2244
852	38	2770	2698
855	41	3500	3428

STORAGE-ELEVATION CURVE FOR SOUHEAGN R. W. DAM # 10-A



For the drainage area of 4109 acres, 1 inch of runoff

$= 1/12\,(4109) = 342.4$ ac-ft.

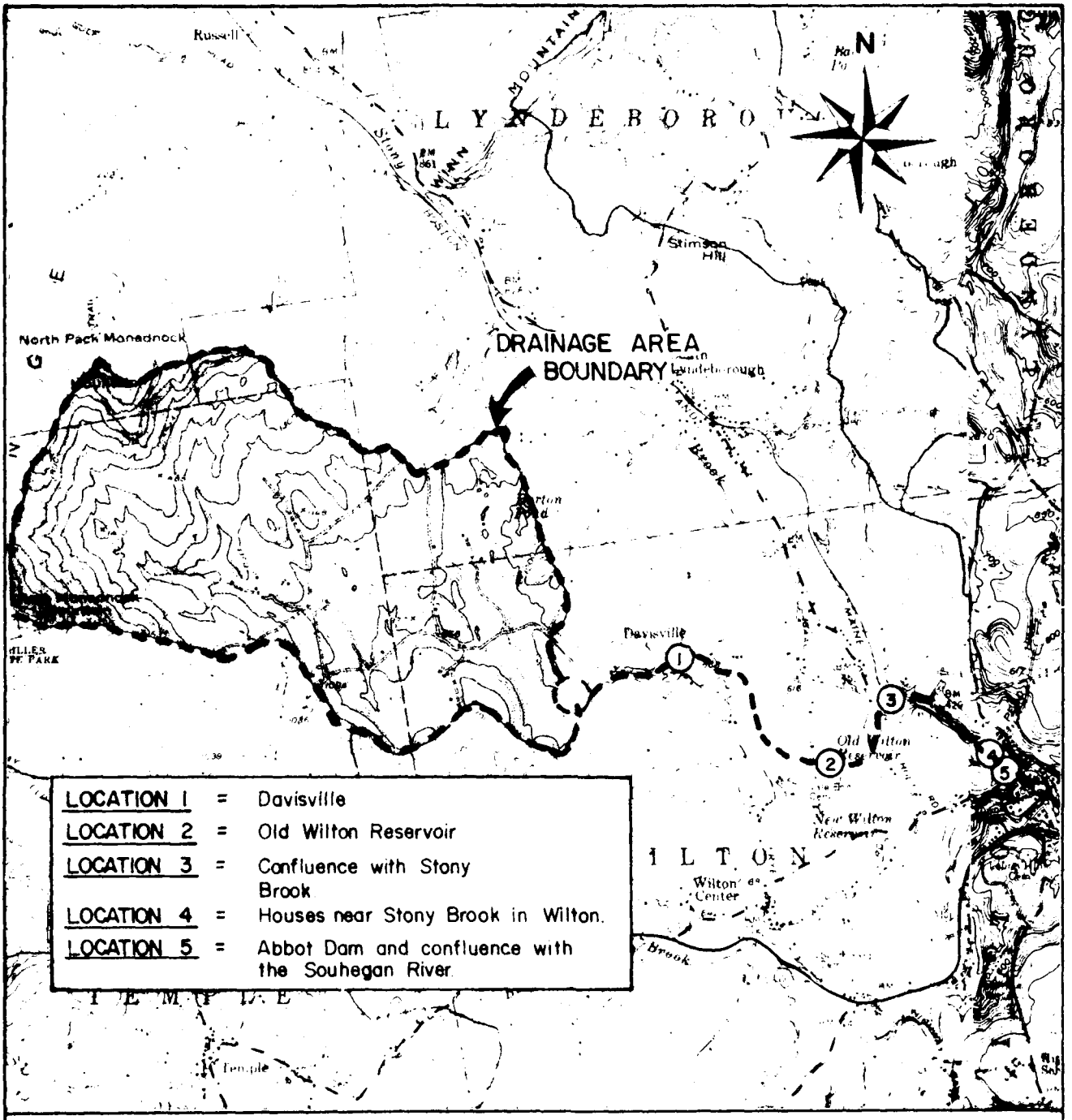
$1\ \text{Ac-Ft} = \frac{1}{342.4} = .00292''$ of runoff

Available storage to emergency spillway crest

$= (1459)(.00292) = 4.26''$

Available storage to dam crest

$= (2698)(.00292) = 7.88''$



SCALE

0 1/2 1 2 (Miles)

FROM USGS MILFORD AND PETERBOROUGH - N.H. QUADRANGLE MAPS

GOLDBERG, ZOINO, DUNNICLIFF & ASSOC., INC
GEOTECHNICAL CONSULTANTS
NEWTON UPPER FALLS, MASS

U.S ARMY ENGINEER DIV NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION AND DOWNSTREAM HAZARD MAP

FILE No. 2201

SOUHEGAN RIVER
WATERSHED DAM No. 10A NEW HAMPSHIRE

SCALE AS NOTED

DATE

Dam Failure Analysis

P. 8 is a location and Downstream Hazard Map for S.R.W. Dam #10A.

The first question to be addressed in the Downstream Hazard Analysis is the assumed water surface elevation at dam failure. The normal assumption is that failure occurs with the water surface at the top of the dam. This would yield a pre-failure outflow of about 14,700 cfs. This flow would create severe flooding downstream prior to dam failure. Dam failure would have a greater incremental impact on flooding if it were to occur with a lower water surface elevation in the reservoir. Therefore, for this analysis Dam failure is assumed to occur with the water surface elevation at S.C.S. Design High Water, 845' MSL, h = 35'. This is 3' below the dam crest, and represents 4' of flow in the emergency spillway. Storage at this elevation is 2075.5 A.F.

Normal outflow at this elevation is 5300 cfs.

Peak failure outflow = Normal outflow + Breach outflow

Breach Outflow:

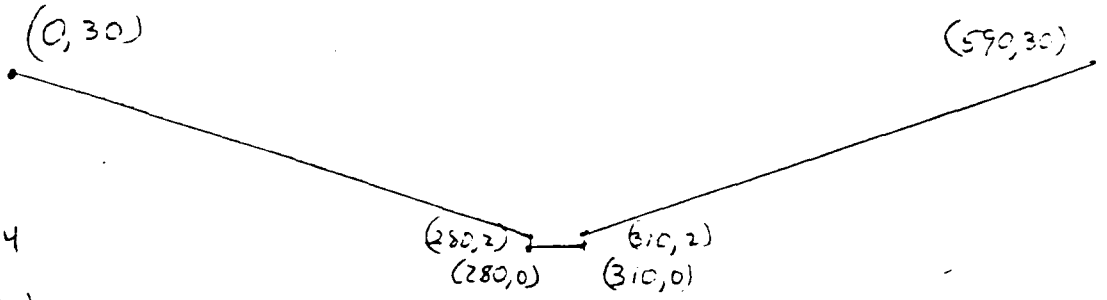
$$Q_{p_1} = 8/27 \sqrt{g}\ W_b (y_o)^{3/2}$$

where: W_b = breach width = 40% of width at ½ height from sheet 4 of the plans, width at ½ height = 364 ft.

$\rightarrow w_b = .4(364) = 145'$

Y_o = h_c above tailwater at time of failure.

The channel just downstream of S.R.W. Dam #10A is represented by this typical cross-section. (field notes & U.S.G.S. quad):



n = .04

S = .024

L = 5000'

A Normal Flow vs. depth relationship for this channel is given on p 11. At 5300 cfs of flow, the depth would be 6.6 ft.

$Y_o = 849 - (793 + 6.6) = 49.4$ ft.

$Q_{p_1} = 8/27 \sqrt{g}\ 145 (49.4)^{3/2} = 84{,}600$ cfs

Peak failure outflow = 5300 + 84,600 = 89,900 cfs.
This would increase the tailwater depth to 19.1 ft, an increase of 12.5 ft.

Downstream of the dam, Mill Brook runs about 5000 ft. to the first damage center, the village of Davisville. The cross-section above is typical for this reach. There are two small dams and

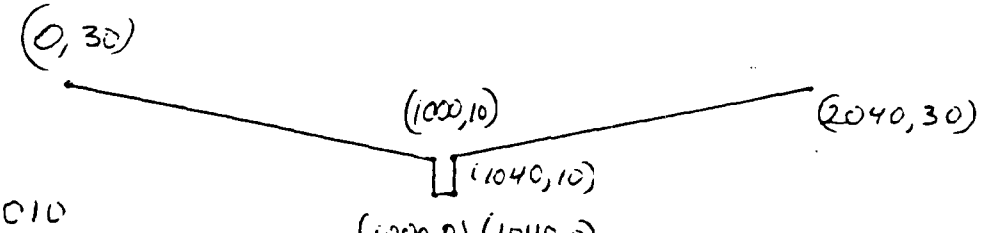
DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.00	0.0	0.0	0.0	0.0	0.0	0.0
1.00	1.0	30.0	32.0	0.9	28.7	165.8
2.00	2.0	60.0	34.0	1.8	87.6	505.7
3.00	3.0	100.0	54.1	1.8	150.6	869.3
4.00	4.0	160.0	74.2	2.2	267.1	1541.5
5.00	5.0	240.0	94.3	2.5	447.5	2582.5
6.00	6.0	340.0	114.4	3.0	703.1	4057.3
7.00	7.0	460.0	134.5	3.4	1044.6	6028.3
8.00	8.0	600.0	154.6	3.9	1482.4	8554.8
9.00	9.0	760.0	174.7	4.4	2026.3	11693.4
10.00	10.0	940.0	194.8	4.8	2685.7	15498.3
11.00	11.0	1140.0	214.9	5.3	3469.5	20021.4
12.00	12.0	1360.0	235.0	5.8	4386.4	25312.9
13.00	13.0	1600.0	255.1	6.3	5445.0	31421.5
14.00	14.0	1860.0	275.2	6.8	6653.3	38394.4
15.00	15.0	2140.0	295.3	7.2	8019.3	46277.4
16.00	16.0	2440.0	315.4	7.7	9550.8	55115.4
17.00	17.0	2760.0	335.5	8.2	11255.4	64952.2
18.00	18.0	3100.0	355.6	8.7	13140.5	75830.4
19.00	19.0	3460.0	375.7	9.2	15213.3	87792.2
20.00	20.0	3840.0	395.8	9.7	17481.0	100873.6
21.00	21.0	4240.0	415.9	10.2	19950.6	115130.0
22.00	22.0	4660.0	436.0	10.7	22629.0	130586.1
23.00	23.0	5100.0	456.1	11.2	25522.9	147286.1
24.00	24.0	5560.0	476.2	11.7	28639.0	165268.2
25.00	25.0	6040.0	496.3	12.2	31983.8	184570.5
26.00	26.0	6540.0	516.4	12.7	35563.9	205230.3
27.00	27.0	7060.0	536.5	13.2	39385.6	227284.4
28.00	28.0	7600.0	556.6	13.7	43455.3	250769.2
29.00	29.0	8160.0	576.7	14.1	47779.0	275720.6
30.00	30.0	8740.0	596.8	14.6	52363.1	302173.9

Reach downstream of dam - to Davisville

one small bridge in this reach. All three would be severely damaged or destroyed by the dam failure flood wave, and none would offer a significant impediment to flows of this magnitude.

The attenuation due to storage in this reach is calculated on p. 13. The attenuated peak failure outflow at Davisville would be 76,500 cfs.

The village of Davisville (Location 1, map on p. 8) consists of about 3 residences and one mill. These buildings are grouped around a small pond on Mill Brook. Under dam failure conditions, this would approximate the cross-section at Davisville (from fieldnotes & U.S.G.S. Quads):



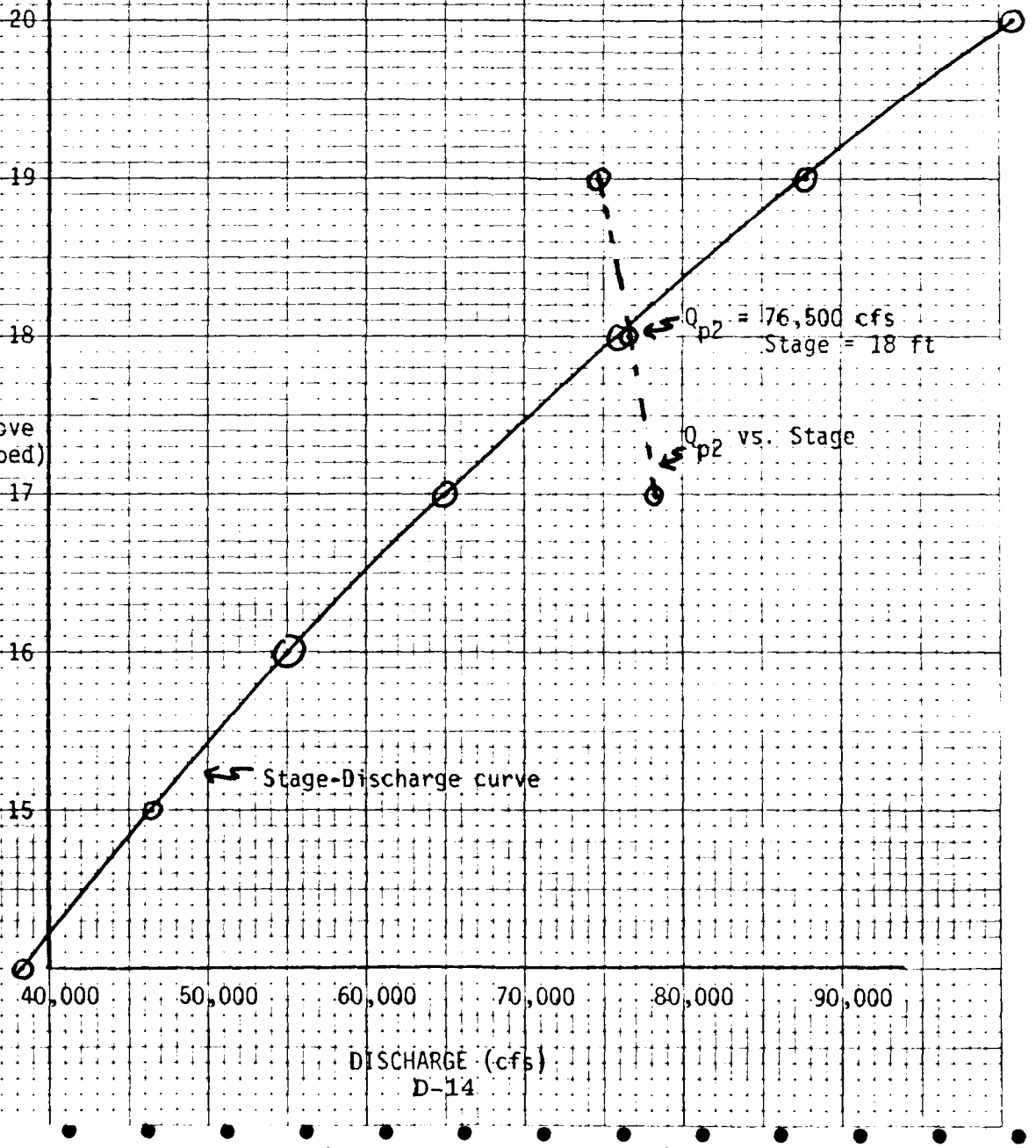
S = .010
n = .045
L = 300'

The depth of flooding at Davisville is estimated by a stage-Normal discharge relationship for this cross-section (p. 14). . . Due to its short length this reach would provide negligible attenuation due to storage. The houses and mill have first floor elevations about . 10 feet above the stream bed. The pre-failure outflow of 5,300 $_{D-f3}$ cfs would generate

ATTENUATED FAILURE OUTFLOW AT DAVISVILLE TCG, 6/7/79, p. 13

$$Q_{p2} = Q_{p1}\left(1 - \frac{STOR}{2076}\right) = 89{,}900\left(1 - \frac{STOR}{2076}\right)$$

ELEVATION (FT.)	AREA (above 6.6 ft) (sq. FT.)	STORAGE $\left(\frac{Area * 5000}{43{,}560}\right)$ (AC-FT)	Q_{p2} (cfs)
17	2348	270	78,200
18	2688	309	76,500
19	3048	350	74,700



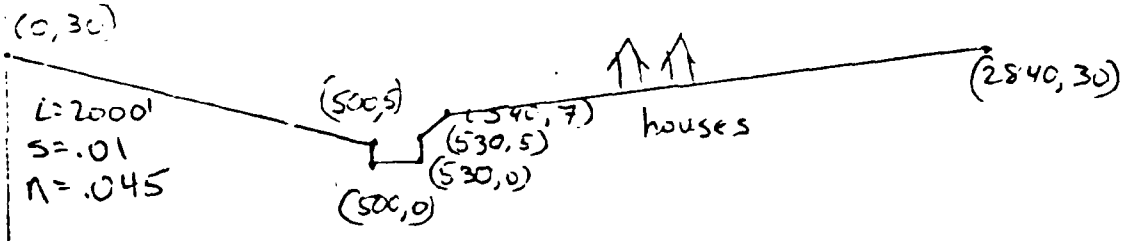
DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.00	0.0	0.0	0.0	0.0	0.0	0.0
1.00	1.0	40.0	42.0	1.0	38.7	128.2
2.00	2.0	80.0	44.0	1.8	119.2	394.7
3.00	3.0	120.0	46.0	2.6	227.5	753.2
4.00	4.0	160.0	48.0	3.3	357.2	1182.6
5.00	5.0	200.0	50.0	4.0	504.2	1669.5
6.00	6.0	240.0	52.0	4.6	665.6	2204.0
7.00	7.0	280.0	54.0	5.2	839.3	2778.9
8.00	8.0	320.0	56.0	5.7	1023.4	3388.6
9.00	9.0	360.0	58.0	6.2	1216.6	4028.3
10.00	10.0	400.0	60.0	6.7	1417.8	4694.4
11.00	11.0	490.0	160.0	3.1	1033.6	3422.5
12.00	12.0	680.0	260.0	2.6	1291.1	4275.0
13.00	13.0	970.0	360.1	2.7	1878.7	6220.4
14.00	14.0	1360.0	460.1	3.0	2802.2	9278.4
15.00	15.0	1850.0	560.1	3.3	4104.7	13591.1
16.00	16.0	2440.0	660.1	3.7	5835.7	19322.5
17.00	17.0	3130.0	760.1	4.1	8044.8	26637.3
18.00	18.0	3920.0	860.2	4.6	10780.6	35695.8
19.00	19.0	4810.0	960.2	5.0	14089.9	46653.1
20.00	20.0	5800.0	1060.2	5.5	18017.8	59658.8
21.00	21.0	6890.0	1160.2	5.9	22608.0	74857.8
22.00	22.0	8080.0	1260.2	6.4	27903.1	92390.3
23.00	23.0	9370.0	1360.3	6.9	33944.1	112392.6
24.00	24.0	10760.0	1460.3	7.4	40771.1	134997.6
25.00	25.0	12250.0	1560.3	7.9	48423.2	160334.4
26.00	26.0	13840.0	1660.3	8.3	56938.5	188529.7
27.00	27.0	15530.0	1760.3	8.8	66354.4	219706.9
28.00	28.0	17320.0	1860.4	9.3	76707.6	253987.2
29.00	29.0	19210.0	1960.4	9.8	88033.7	291489.5
30.00	30.0	21200.0	2060.4	10.3	100368.2	332330.3

REACH THROUGH DAVISVILLE

slight flooding at these houses. The peak dam failure outflow would increase flooding from about 1 foot to 11 feet at these houses.

Although it is difficult to define the controlling cross-section at Davisville, it is clear that dam failure would produce a large increase in flow and flooding depth in the village, sufficient to destroy or severely damage the structures in the village and present a significant threat of loss of life. There is also a road crossing in the town which would probably be destroyed by the dam failure outflow.

The next damage center downstream of Davisville is a group of 2 houses, 13 and fourteen feet above the streambed, 2000 ft. down Mill Brook from the village. The cross section in this reach is taken from field notes and a U.S.G.S. quad:



NOT TO SCALE

The Stage-Normal Discharge Relationship for this reach is given on p. 16, and the attenuation due to storage in [illegible] is calculated on p. 17.

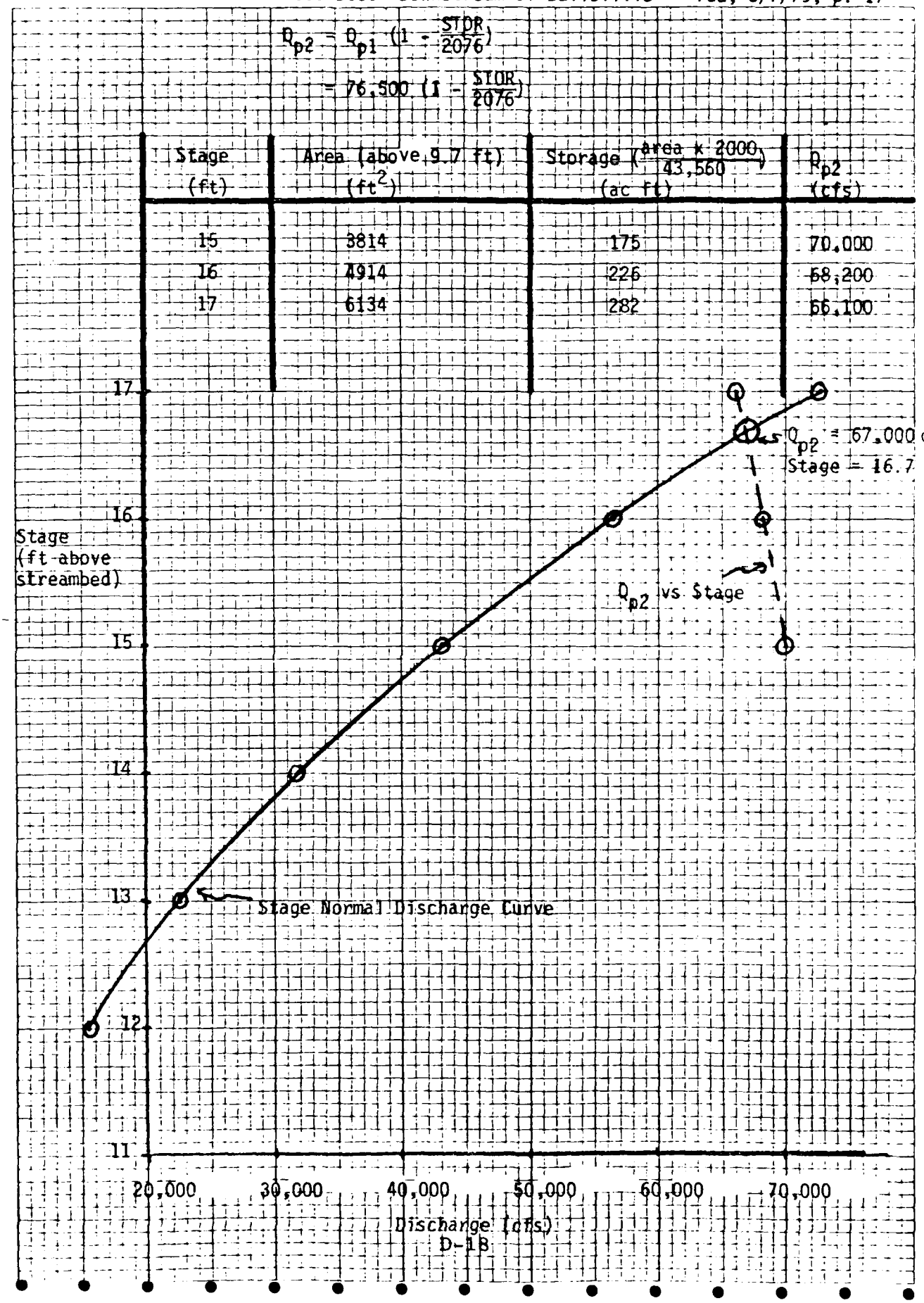
DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.00	0.0	0.0	0.0	0.0	0.0	0.0
1.00	1.0	30.0	32.0	0.9	28.7	95.1
2.00	2.0	60.0	34.0	1.8	87.6	290.2
3.00	3.0	90.0	36.0	2.5	165.8	549.1
4.00	4.0	120.0	38.0	3.2	258.4	855.6
5.00	5.0	150.0	40.0	3.8	362.2	1199.3
6.00	6.0	192.5	65.1	3.0	396.6	1313.3
7.00	7.0	260.0	90.2	2.9	526.6	1743.6
8.00	8.0	400.0	210.3	1.9	614.2	2033.8
9.00	9.0	660.0	330.3	2.0	1047.3	3467.6
10.00	10.0	1040.0	450.3	2.3	1817.5	6018.1
11.00	11.0	1540.0	570.4	2.7	2987.0	9890.4
12.00	12.0	2160.0	690.4	3.1	4622.3	15304.8
13.00	13.0	2900.0	810.4	3.6	6787.4	22473.9
14.00	14.0	3760.0	930.5	4.0	9543.7	31600.3
15.00	15.0	4740.0	1050.5	4.5	12949.5	42877.4
16.00	16.0	5840.0	1170.5	5.0	17060.9	56490.6
17.00	17.0	7060.0	1290.5	5.5	21931.6	72618.1
18.00	18.0	8400.0	1410.6	6.0	27613.8	91432.3
19.00	19.0	9860.0	1530.6	6.4	34157.7	113099.9
20.00	20.0	11440.0	1650.6	6.9	41612.4	137783.2
21.00	21.0	13140.0	1770.7	7.4	50025.5	165639.8
22.00	22.0	14960.0	1890.7	7.9	59443.5	196823.9
23.00	23.0	16900.0	2010.7	8.4	69911.8	231485.7
24.00	24.0	18960.0	2130.8	8.9	81475.0	269772.7
25.00	25.0	21140.0	2250.8	9.4	94176.6	311829.1
26.00	26.0	23440.0	2370.8	9.9	108059.3	357796.4
27.00	27.0	25860.0	2490.8	10.4	123165.2	407813.8
28.00	28.0	28400.0	2610.9	10.9	139535.6	462017.9
29.00	29.0	31060.0	2730.9	11.4	157211.0	520543.2
30.00	30.0	33840.0	2850.9	11.9	176231.5	583522.2

REACH - DAVISVILLE TO HOUSES 2000 FT. DOWNSTREAM OF DAVISVILLE

$$Q_{p2} = Q_{p1}\left(1 - \frac{STOR}{2076}\right)$$

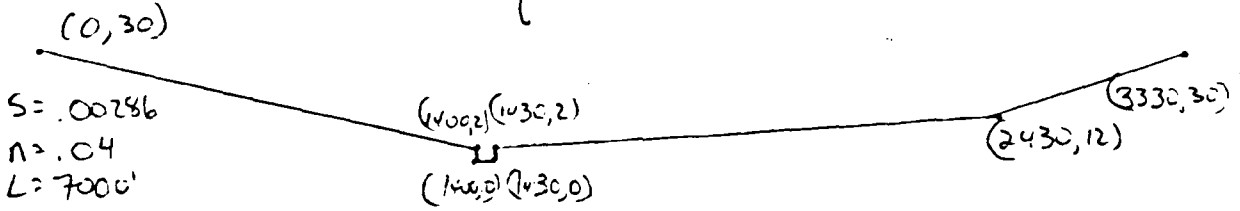
$$= 76{,}500\left(1 - \frac{STOR}{2076}\right)$$

Stage (ft)	Area (above 9.7 ft) (ft^2)	Storage ($\frac{\text{area} \times 2000}{43{,}560}$) (ac ft)	Q_{p2} (cfs)
15	3814	175	70,000
16	4914	226	68,200
17	6134	282	66,100



The attenuated peak outflow at the houses would be 67,000 cfs, which would yield a stage of 16.7 ft. The pre-failure stage would be 9.7 feet. This seven foot increase would increase the level of flooding at the houses from none to between 2.5 and four feet, which would damage these structures and might cause loss of life.

Mill Brook then flows about 7000 feet to Old Wilton Reservoir. Most of this reach is in a broad floodplain, with the brook meandering through. There are two houses near the downstream end of this reach. The following typical cross-section is taken from a U.S.G.S. quad sheet:



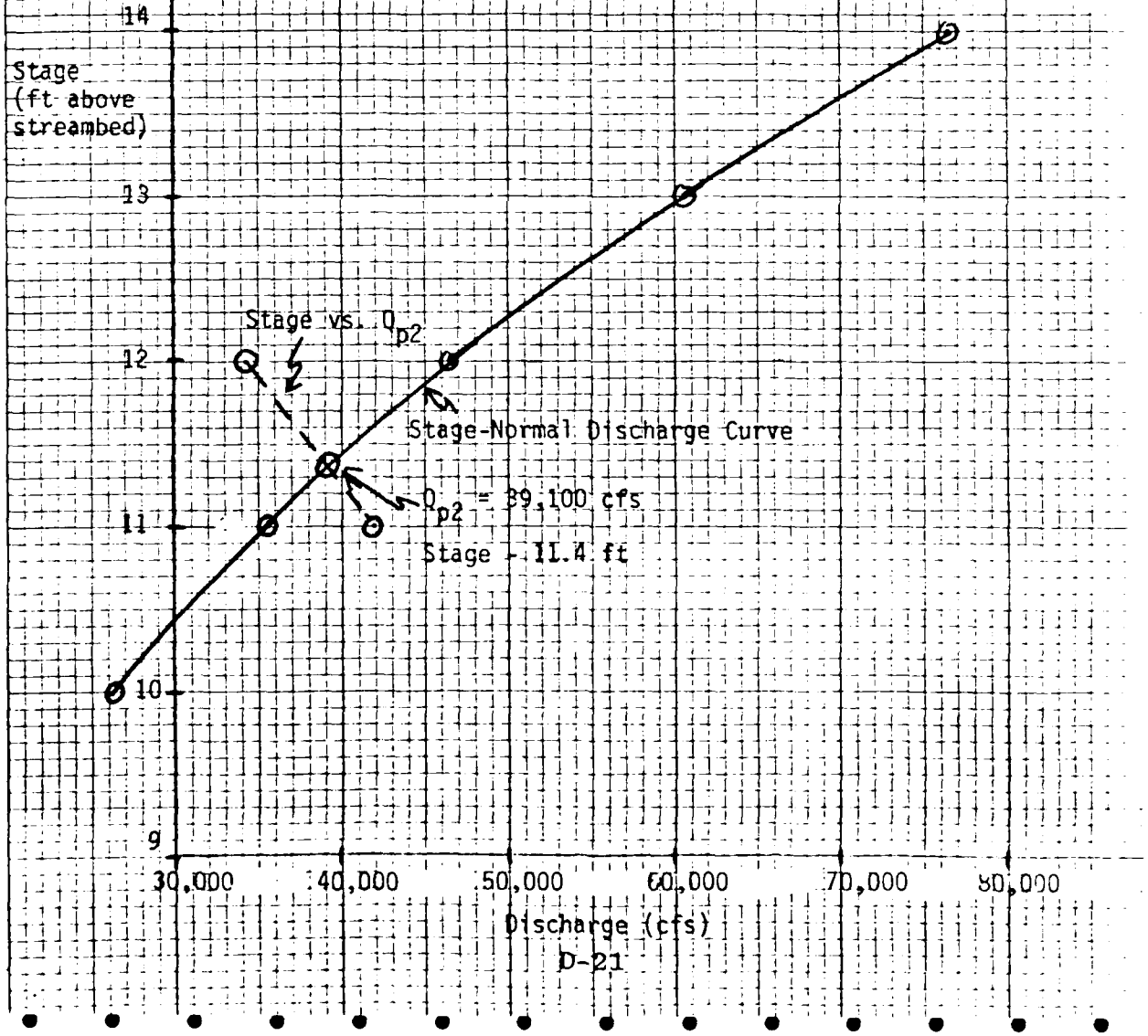
The Stage-Normal Discharge Relationship for this reach is given on p. 19. The pre-failure outflow of 5300 cfs would produce a stage of about 6.2 ft. The attenuation due to storage in this reach is calculated on p. 20. The attenuated discharge at the end of this reach is 39,100 cfs, which produces a stage of 11.4 ft. This stage would not threaten the houses nearby.

DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.00	0.0	0.0	0.0	0.0	0.0	0.0
1.00	1.0	30.0	32.0	0.9	28.7	57.2
2.00	2.0	60.0	34.0	1.8	87.6	174.6
3.00	3.0	165.0	184.0	0.9	153.4	305.6
4.00	4.0	420.0	334.0	1.3	489.3	974.8
5.00	5.0	825.0	484.0	1.7	1177.4	2345.4
6.00	6.0	1380.0	634.1	2.2	2318.2	4618.1
7.00	7.0	2085.0	784.1	2.7	4003.3	7974.9
8.00	8.0	2940.0	934.1	3.1	6316.6	12583.3
9.00	9.0	3945.0	1084.1	3.6	9337.2	18600.6
10.00	10.0	5100.0	1234.1	4.1	13139.7	26175.4
11.00	11.0	6405.0	1384.1	4.6	17795.1	35449.5
12.00	12.0	7860.0	1534.1	5.1	23372.0	46559.1
13.00	13.0	9440.0	1634.2	5.8	30409.5	60578.5
14.00	14.0	11120.0	1734.2	6.4	38404.2	76504.8
15.00	15.0	12900.0	1834.2	7.0	47384.1	94393.4
16.00	16.0	14780.0	1934.2	7.6	57378.1	114302.5
17.00	17.0	16760.0	2034.2	8.2	68416.2	136291.4
18.00	18.0	18840.0	2134.3	8.8	80528.7	160420.5
19.00	19.0	21020.0	2234.3	9.4	93746.0	186750.6
20.00	20.0	23300.0	2334.3	10.0	108098.7	215342.6
21.00	21.0	25680.0	2434.3	10.5	123617.5	246257.3
22.00	22.0	28160.0	2534.3	11.1	140332.6	279555.4
23.00	23.0	30740.0	2634.4	11.7	158274.5	315297.3
24.00	24.0	33420.0	2734.4	12.2	177473.2	353542.9
25.00	25.0	36200.0	2834.4	12.8	197958.7	394351.9
26.00	26.0	39080.0	2934.4	13.3	219760.6	437793.3
27.00	27.0	42060.0	3034.4	13.9	242908.5	483896.0
28.00	28.0	45140.0	3134.5	14.4	267431.6	532748.1
29.00	29.0	48320.0	3234.5	14.9	293358.8	584397.6
30.00	30.0	51600.0	3334.5	15.5	320719.0	638901.6

REACH FROM HOUSES D/S OF DAVISVILLE TO OLD WILTON RESERVOIR

$$Q_{p2} = 67,000 \left(1 - \frac{STOR}{2076}\right)$$

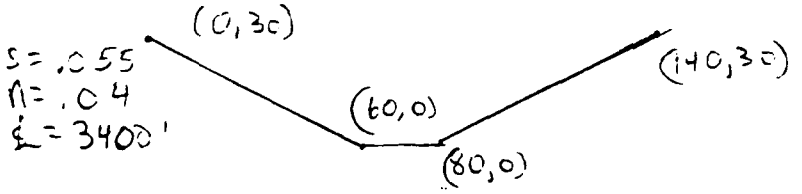
Stage (ft)	Area (above 6.2 ft) (ft^2)	Storage ($\frac{\text{area} \times 7000}{43,560}$) (ac ft)	Q_{p2} (cfs)
12	6339	1019	34,100
11	4884	785	41,700



which are 15-20 ft. above the streambed.

The Old Wilton Reservoir Dam would probably be severely overtopped and damaged by the peak failure flow of 39,100 cfs. This is a run-of-the river dam, and would not offer significant attenuation to the dam failure flood wave.

Downstream of old Wilton Reservoir, Mill Brook joins Stockwell Brook, and proceeds 3700 ft. to flow into Stony Brook. The first 3400 feet of this stretch are represented by this cross-section, determined from field notes and a U.S.G.S. quad sheet:



This reach is quite steep, with the stream confined to a narrow gorge. The pre-failure flow of 5300 cfs would increase slightly due to inflow from Stockwell Brook. We will assume this inflow as 1000 cfs. The combined pre-failure flow of 6300 cfs would cause 7.3 ft. of flow in the channel, as shown on the Normal Flow Relationship given on p. 22. The attenuation due to storage in this reach is calculated on p. 23.

The attenuated dam failure flow at the end of this reach is 38,000 cfs, which would yield a stage of 12.7 ft. There are no structures on this reach.

DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.00	0.0	0.0	0.0	0.0	0.0	0.0
1.00	1.0	22.0	24.5	0.9	20.5	179.0
2.00	2.0	48.0	28.9	1.7	67.3	587.6
3.00	3.0	78.0	33.4	2.3	137.3	1199.4
4.00	4.0	112.0	37.9	3.0	230.8	2016.0
5.00	5.0	150.0	42.4	3.5	348.6	3045.6
6.00	6.0	192.0	46.8	4.1	492.0	4298.5
7.00	7.0	238.0	51.3	4.6	662.3	5786.1
8.00	8.0	288.0	55.8	5.2	860.8	7520.2
9.00	9.0	342.0	60.2	5.7	1088.9	9512.7
10.00	10.0	400.0	64.7	6.2	1347.9	11775.3
11.00	11.0	462.0	69.2	6.7	1639.2	14320.0
12.00	12.0	528.0	73.7	7.2	1964.1	17158.2
13.00	13.0	598.0	78.1	7.7	2323.9	20301.6
14.00	14.0	672.0	82.6	8.1	2720.0	23761.4
15.00	15.0	750.0	87.1	8.6	3153.5	27548.8
16.00	16.0	832.0	91.6	9.1	3625.8	31674.8
17.00	17.0	918.0	96.0	9.6	4138.1	36150.3
18.00	18.0	1008.0	100.5	10.0	4691.7	40986.0
19.00	19.0	1102.0	105.0	10.5	5287.7	46192.6
20.00	20.0	1200.0	109.4	11.0	5927.3	51780.4
21.00	21.0	1302.0	113.9	11.4	6611.8	57759.7
22.00	22.0	1408.0	118.4	11.9	7342.2	64140.8
23.00	23.0	1518.0	122.9	12.4	8119.8	70933.7
24.00	24.0	1632.0	127.3	12.8	8945.7	78148.5
25.00	25.0	1750.0	131.8	13.3	9820.9	85794.8
26.00	26.0	1872.0	136.3	13.7	10746.7	93882.5
27.00	27.0	1998.0	140.7	14.2	11724.2	102421.2
28.00	28.0	2128.0	145.2	14.7	12754.3	111420.5
29.00	29.0	2262.0	149.7	15.1	13838.3	120889.7
30.00	30.0	2400.0	154.2	15.6	14977.1	130838.3

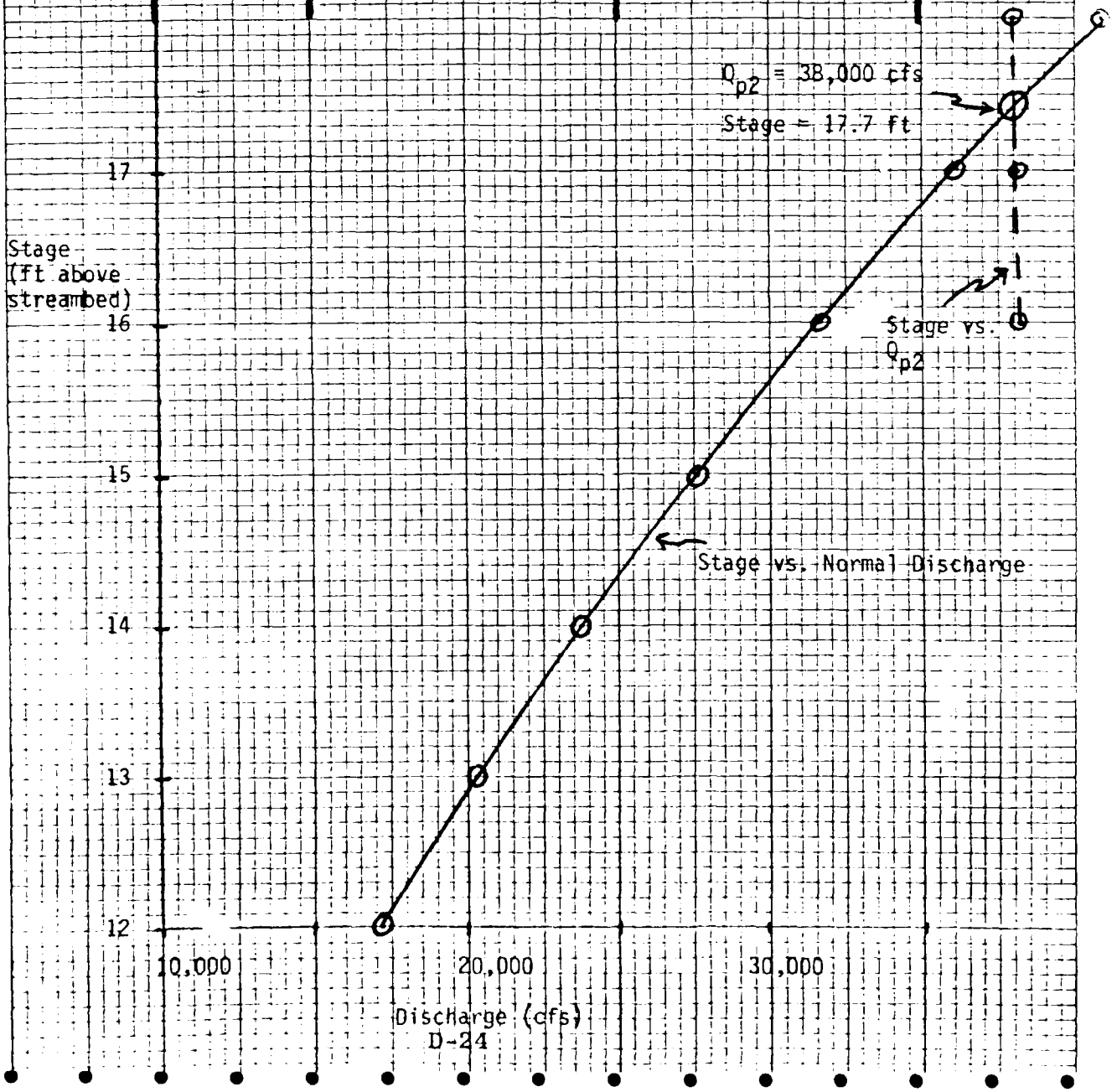
REACH FROM OLD WILTON RESERVOIR TO STONY BROOK

Attenuated Flow 300 ft above Confluence with Stony Brook

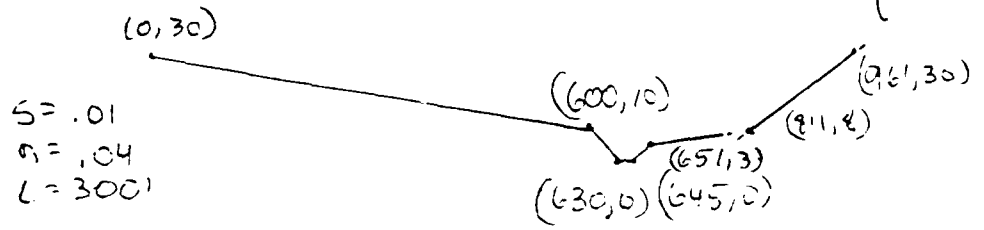
TCG, 6/7/79, p. 23

$Q_{p2} = 39,100 \left(1 - \frac{STOR}{2076}\right)$

Stage (ft)	Area (above 6.7 ft) (ft^2)	Storage ($\frac{\text{Area} \times 3400}{43,560}$) (ac ft)	Q_{p2} (cfs)
16	589	46.0	38,200
17	675	52.7	38,100
18	765	59.7	38,000



About 300' upstream of the confluence with Stony Brook, Mill Brook leaves the gorge and flattens out considerably. This reach has one trailer about eight feet above the streambed and one house under construction about 15 feet above the streambed. The following typical cross-section of the reach is based on field notes and a U.S.G.S. quad:



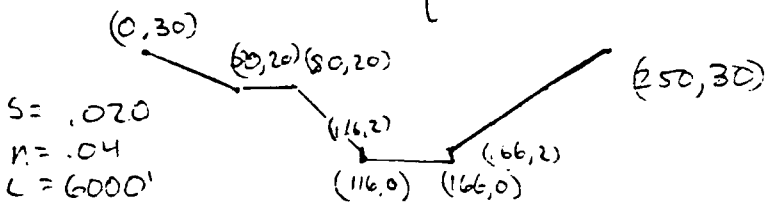
A Stage-Normal Discharge Relationship for this reach is given on p. 25 The pre-failure outflow of 6300 cfs would cause a stage of about 9.6 feet, which would create 1-2 feet of flooding at the trailer. The peak dam failure outflow would increase the stage to about 17.5 ft, which would create 9.5 ft. of flooding at the trailer, and 2.5 ft. at the house. This sudden rise could present a threat of loss of life in this area.

Mill Brook flows into Stony Brook, which flows about 6000 ft. alongside of State Highway 31 to the town of Wilton. This reach has no development, although the Boston and Maine Railroad does cross Stony Brook on a high trestle.

DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.00	0.0	0.0	0.0	0.0	0.0	0.0
1.00	1.0	17.5	20.4	0.9	15.8	58.9
2.00	2.0	40.0	25.8	1.6	53.6	199.6
3.00	3.0	67.5	31.2	2.2	113.0	420.7
4.00	4.0	105.7	47.7	2.2	179.5	668.8
5.00	5.0	160.2	64.3	2.5	294.5	1097.1
6.00	6.0	231.0	80.8	2.9	465.5	1734.0
7.00	7.0	318.2	97.3	3.3	701.1	2611.6
8.00	8.0	421.7	113.9	3.7	1009.8	3761.4
9.00	9.0	541.5	130.4	4.2	1399.7	5213.9
10.00	10.0	677.7	146.9	4.6	1878.7	6998.0
11.00	11.0	843.7	190.3	4.4	2277.8	8484.9
12.00	12.0	1053.0	233.7	4.5	2874.0	10705.8
13.00	13.0	1305.7	277.1	4.7	3671.7	13677.0
14.00	14.0	1601.7	320.5	5.0	4684.4	17449.5
15.00	15.0	1941.0	363.9	5.3	5929.2	22086.1
16.00	16.0	2322.0	403.9	5.7	7455.7	27772.3
17.00	17.0	2743.0	444.0	6.2	9241.0	34422.8
18.00	18.0	3204.0	484.1	6.6	11302.1	42100.4
19.00	19.0	3705.0	524.1	7.1	13655.4	50866.3
20.00	20.0	4246.0	564.2	7.5	16316.9	60780.6
21.00	21.0	4827.0	604.3	8.0	19302.4	71901.6
22.00	22.0	5448.0	644.3	8.5	22627.3	84286.6
23.00	23.0	6109.0	684.4	8.9	26306.4	97991.5
24.00	24.0	6810.0	724.5	9.4	30354.7	113071.2
25.00	25.0	7551.0	764.5	9.9	34786.4	129579.4
26.00	26.0	8332.0	804.6	10.4	39615.8	147569.0
27.00	27.0	9153.0	844.7	10.8	44856.8	167091.7
28.00	28.0	10014.0	884.7	11.3	50523.2	188198.8
29.00	29.0	10915.0	924.8	11.8	56628.3	210940.3
30.00	30.0	11856.0	964.9	12.3	63185.4	235365.6

REACH AT HOUSE AND TRAILER JUST UPSTREAM OF CONFLUENCE WITH STONY BK.

The following typical cross-section is based on field notes and U.S.G.S. quads:



The Stage-Normal Discharge relationship for this reach is given on p. 27. The pre-failure flow of 6300 cfs would be augmented by inflow from Stony Brook. This inflow is assumed to be 2000 cfs. The combined flow of 8300 cfs would yield 8 ft. of flow. The attenuation due to storage in this reach is calculated on p. 28. The attenuated peak flow at Wilton is 35,700 cfs, which yields a stage of 17 ft.

At the outskirts of Wilton, Stony Brook becomes much less steep. The brook flows alongside of State Highway 31, and there is a row of houses between the highway and the brook. The first floor of these houses is quite close to the stream. There are 9 houses with first floors 7'-12' above the streambed, and two about 18 feet above. There is also an apartment building about 12' above the streambed and a laundry about 10' up. Across Highway 31 there are numerous (20+) houses and businesses about 25 ft. above the streambed.

The cross-section for this reach given on p. 29 is based on field notes.

DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.00	0.0	0.0	0.0	0.0	0.0	0.0
1.00	1.0	50.0	52.0	1.0	48.7	256.6
2.00	2.0	100.0	54.0	1.9	150.8	794.6
3.00	3.0	152.5	59.4	2.6	286.0	1506.8
4.00	4.0	210.0	64.8	3.2	460.1	2423.7
5.00	5.0	272.5	70.2	3.9	673.4	3547.4
6.00	6.0	340.0	75.6	4.5	926.9	4882.8
7.00	7.0	412.5	81.0	5.1	1221.7	6436.1
8.00	8.0	490.0	86.4	5.7	1559.3	8214.4
9.00	9.0	572.5	91.8	6.2	1941.0	10225.2
10.00	10.0	660.0	97.2	6.8	2368.3	12476.3
11.00	11.0	752.5	102.6	7.3	2842.8	14975.6
12.00	12.0	850.0	108.0	7.9	3365.8	17731.0
13.00	13.0	952.5	113.4	8.4	3939.0	20750.5
14.00	14.0	1060.0	118.8	8.9	4563.8	24042.1
15.00	15.0	1172.5	124.2	9.4	5241.8	27613.6
16.00	16.0	1290.0	129.6	10.0	5974.4	31473.0
17.00	17.0	1412.5	135.0	10.5	6763.2	35628.1
18.00	18.0	1540.0	140.4	11.0	7609.5	40086.6
19.00	19.0	1672.5	145.8	11.5	8514.9	44856.2
20.00	20.0	1810.0	151.2	12.0	9480.8	49944.5
21.00	21.0	1984.0	189.4	10.5	9504.8	50070.6
22.00	22.0	2166.0	197.7	11.0	10693.4	56332.4
23.00	23.0	2356.0	206.0	11.4	11971.0	63062.7
24.00	24.0	2554.0	214.2	11.9	13340.1	70275.0
25.00	25.0	2760.0	222.5	12.4	14803.2	77982.6
26.00	26.0	2974.0	230.7	12.9	16362.8	86198.6
27.00	27.0	3196.0	239.0	13.4	18021.4	94935.8
28.00	28.0	3426.0	247.3	13.9	19781.4	104207.1
29.00	29.0	3664.0	255.5	14.3	21645.1	114025.1
30.00	30.0	3910.0	263.8	14.8	23614.9	124402.2

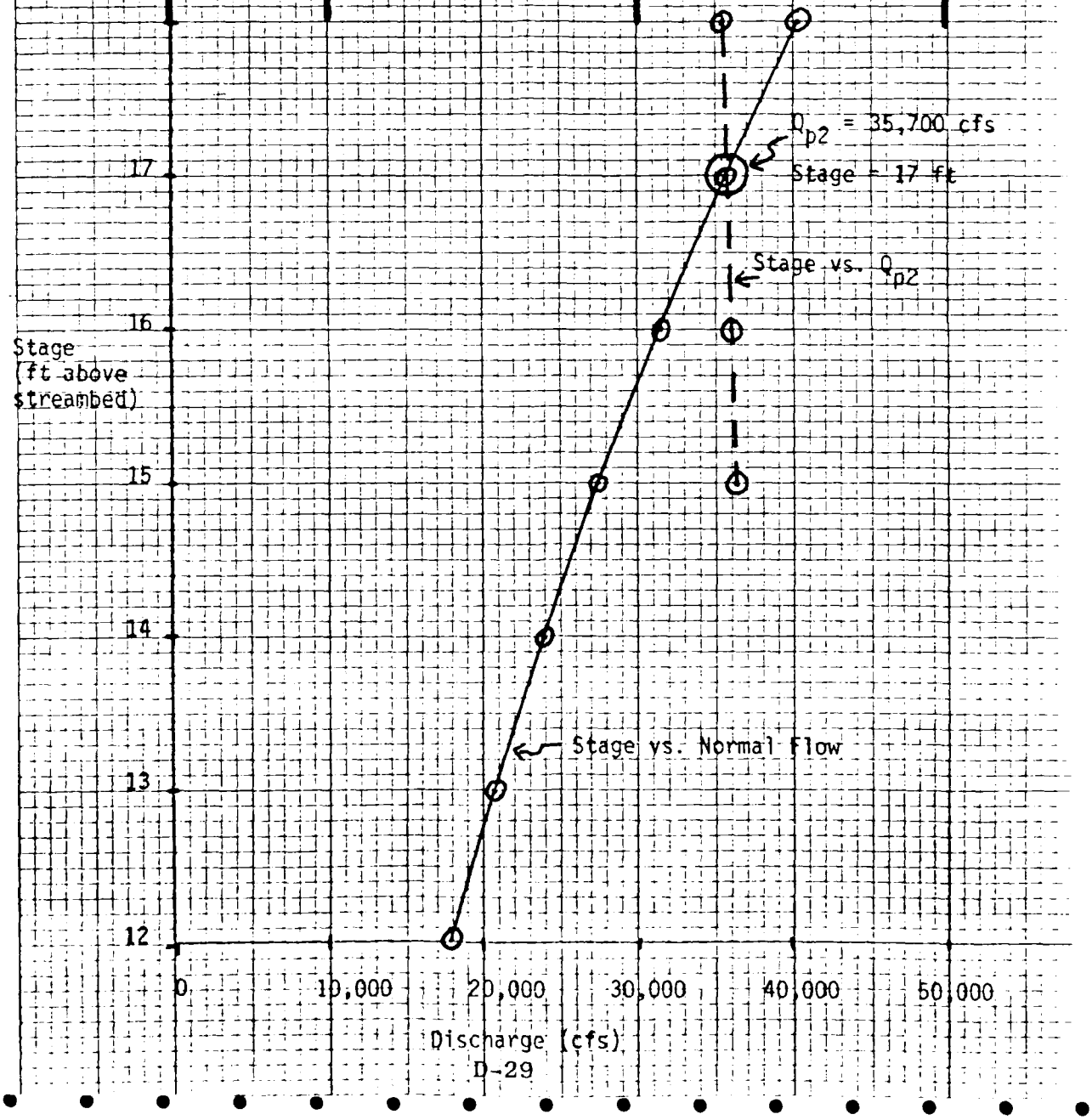
REACH OF STONY BROOK FROM CONFLUENCE TO WILTON

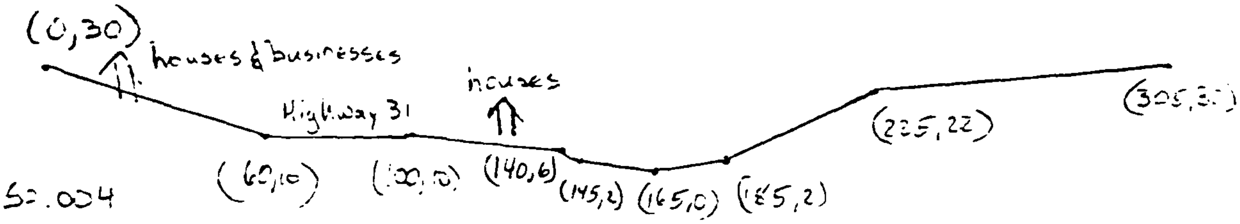
Attenuated Flow at Wilton

TCG, 6/8/79, p. 28

$$Q_{p2} = 38{,}000 \left(1 - \frac{STOR}{2076}\right)$$

Stage (ft)	Area (above 6.3 ft) (ft^2)	Storage ($\frac{area \times 6000}{43{,}560}$) (ac ft)	Q_{p2} (cfs)
15	683	94	36,300
16	800	110	36,000
17	923	127	35,700
18	1050	145	35,350





S=.004
n=.05
L=520'

The Stage-Normal Discharge Relationship for this reach is given on p. 30. Attenuation in this short reach would be negligible. The pre-failure outflow of 8,300 cfs would create a stage of 14.3 ft, which would cause severe flooding problems at the houses and businesses on the bank. (This flow compares to the F.I.S. 500 year flow of 8100 cfs on Stony Brook.) The dam failure flow of 35,700 cfs would yield a stage of 25.5 feet, which would cause extreme and dangerous flooding of all the houses and businesses between Highway 31 and the brook.

Downstream of the residences and still in the town of Wilton, Stony Brook passes over Abbot Memorial Trust Dam and flows into the Souhegan. The flow of about 35,000 cfs would create serious flooding on the Souhegan in Wilton, along which a few (5-10) houses and businesses are located. Downstream of Wilton the Souhegan flows through about 5 miles of broad floodplain before reaching the town

DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.00	0.0	0.0	0.0	0.0	0.0	0.0
1.00	1.0	10.0	20.1	0.5	6.3	11.8
2.00	2.0	40.0	40.2	1.0	39.9	75.1
3.00	3.0	81.6	44.0	1.9	123.2	232.2
4.00	4.0	126.5	47.9	2.6	241.9	455.8
5.00	5.0	174.6	51.7	3.4	393.2	741.1
6.00	6.0	226.0	55.5	4.1	576.2	1086.1
7.00	7.0	285.0	67.8	4.2	742.4	1399.3
8.00	8.0	356.0	80.1	4.4	962.7	1814.4
9.00	9.0	439.0	92.4	4.8	1241.3	2339.5
10.00	10.0	534.0	104.7	5.1	1583.2	2983.9
11.00	11.0	677.5	150.1	4.5	1851.4	3489.4
12.00	12.0	826.0	155.5	5.3	2516.2	4742.3
13.00	13.0	979.5	160.9	6.1	3267.8	6158.9
14.00	14.0	1138.0	166.3	6.8	4104.7	7736.2
15.00	15.0	1301.5	171.7	7.6	5025.9	9472.5
16.00	16.0	1470.0	177.1	8.3	6031.0	11366.7
17.00	17.0	1643.5	182.5	9.0	7119.7	13418.5
18.00	18.0	1822.0	187.9	9.7	8292.0	15628.1
19.00	19.0	2005.5	193.3	10.4	9548.3	17995.8
20.00	20.0	2194.0	198.7	11.0	10888.8	20522.4
21.00	21.0	2387.5	204.1	11.7	12314.2	23208.7
22.00	22.0	2586.0	209.5	12.3	13824.9	26056.1
23.00	23.0	2793.5	222.7	12.5	15094.6	28449.1
24.00	24.0	3014.0	235.9	12.8	16486.5	31072.4
25.00	25.0	3247.5	249.1	13.0	18003.7	33932.0
26.00	26.0	3494.0	262.3	13.3	19649.9	37034.4
27.00	27.0	3753.5	275.5	13.6	21428.5	40386.6
28.00	28.0	4026.0	288.7	13.9	23343.3	43995.6
29.00	29.0	4311.5	302.0	14.3	25398.2	47868.5
30.00	30.0	4610.0	315.2	14.6	27597.0	52012.5

of Milford. It is expected that the dam failure outflow would be essentially attenuated in this reach.

The following chart summarizes the downstream impacts of the failure of Southegan R.W. Dam ≐ 10A.

Location ≐ (Map, p.8)	location	# of dwellings	level above Streambed (ft)	Flow and Stage before failure	Flow and Stage after failure	Comments
	tailwater	—	—	5,300 cfs 6.6 ft	89,900 cfs 19.1 ft.	
①	Davisville	3±1 mill	10'±	5,300 10-11 ft	76,500 21 ft	3 dams + 2 bridges in area damaged. Danger of loss of life.
	houses, 2000' d/s of ①	2	13-14	5300 9.7 ft.	67,000 16.7 ft.	
②	Old Wilton Res.	—	—	5,300 cfs	39,100 cfs	significant attenuation in flood flow. Old Wilton Res. Dam damaged or destroyed
③	confluence with Stony Brook	2	8 and 15	6,300 cfs 9.6 ft	38,000 cfs 17.5 ft	danger of loss of life
④	houses in Wilton	9 2 apartment laundry	7-12 14 12 10	8300 cfs 14.3 ft.	35,700 cfs 25.5 ft.	devastating flooding. High potential for loss of life
⑤	confluence with Southegan	—	—	8300 cfs	35,700 cfs	—
	Southegan	5-10	—	8300 cfs	35,000 cfs±	flooding in Wilton, first pool, otherwise insignificant

Test Flood Analysis

Size Classification. Intermediate
Hazard Classification. High

The hazard classification is HIGH due to the potential for serious economic losses and severe loss of life at numerous locations downstream of the dam in the event of dam failure (see Chart, p.31).

TEST FLOOD = PMF

Using the COE NED "Maximum Probable Flood Peak Flow Rates", the upstream drainage area of 6.4 sq. mi. with mountainous terrain would yield a peak PMF inflow of 2140 csm.

Peak inflow = (6.4)(2140) = 13,700 cfs.

The S.C.S. Freeboard Hydrograph for this dam, which is approximately equivalent to the PMF, is 11747 cfs. Their routed peak outflow is 9200 cfs (p. 37 of calculations), which would yield a stage of about 850.4 ft, 1.6 ft below the top of the dam.

Since the test flood generated by the COE methodology is larger (& therefore more conservative) we will use that as the test flood. Attenuation by storage in

The reservoir is calculated on p. 34.

The attenuated peak outflow is 9400cfs, which yields an elevation of 850.5 ft MSL, 36.5 ft above the low flow outlet and 1.5 ft. below the top of the dam.

Drawdown time

On p. 33 of the Hydrologic and Hydraulic Design Calculations, the SCS gives the drawdown time from the emergency spillway crest (elevation 845' MSL) to the Low flow outlet (elevation 814' MSL) as 9.09 days. The pool reaches elevation 831.5 in 5 days. The S.C.S. begins their Freeboard Hydrograph routing from this elevation

Transpisition of Gage Peak discharge. (Gage u/s of dam)

$$\frac{Q_{Dam}}{Q_{gage}} = \left(\frac{A_{Dam}}{A_{gage}}\right)^{.75} \rightarrow Q_{Dam} = 336\left(\frac{6.4}{36}\right)^{.75}$$

$Q_{peak\ at\ dam}$ = 520 cfs in fourteen years of record

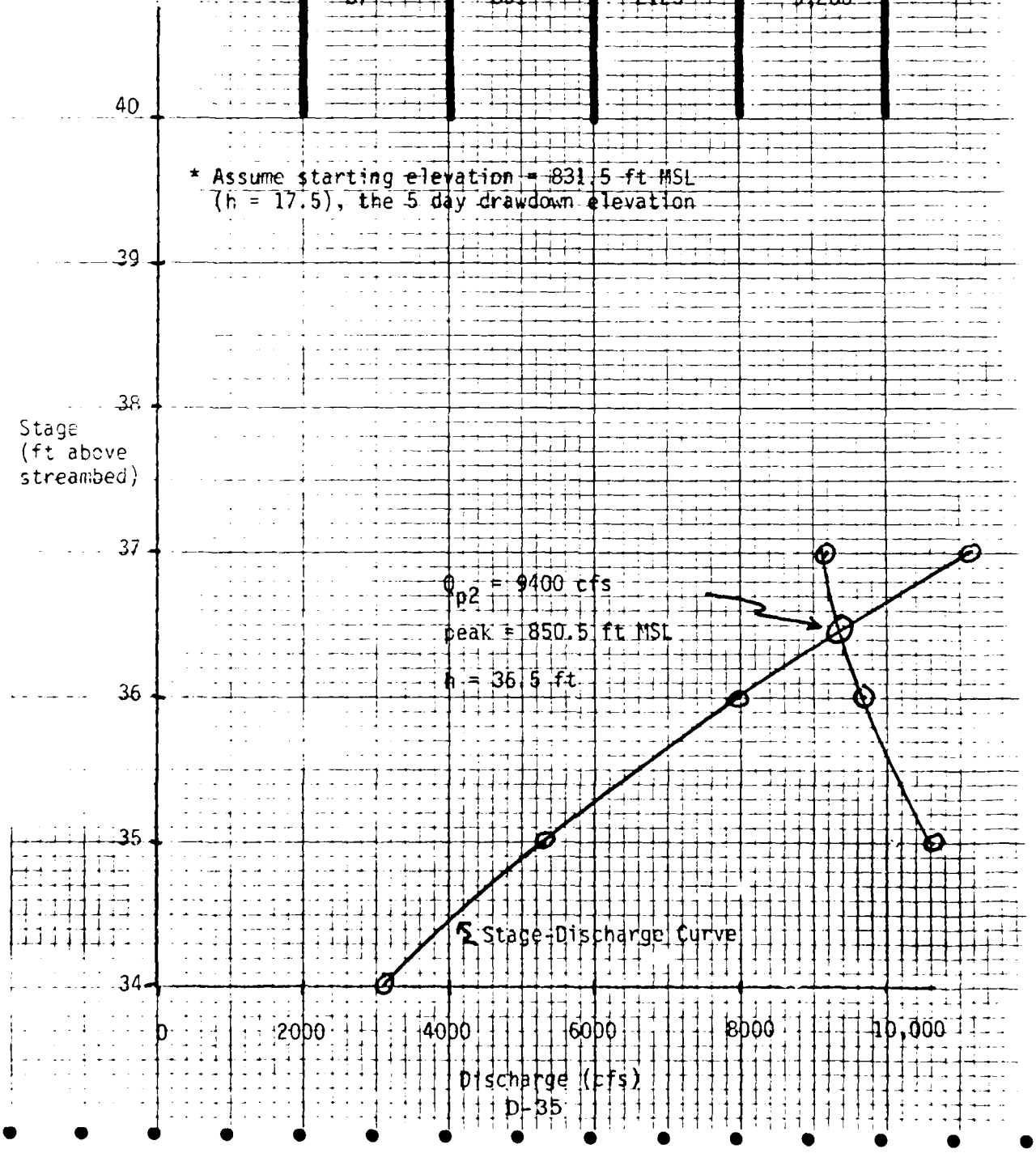
$Q_{p2} = 13{,}700 \left(1 - \frac{STOR}{19"}\right)$

$= 13{,}700 \left(1 - \frac{.00292\ Stor}{19"}\right)$

STOR = ac ft above 831.5 ft* MSL (.00292"(ac ft))

Stage (ft)	Elevation (ft MSL)	Storage (ac ft)	Q_{p2} (cfs)
0	B14	0	13,700
35	B49	1730	10,600
36	B50	1898	9,700
37	B51	2125	9,200

* Assume starting elevation = 831.5 ft MSL (h = 17.5), the 5 day drawdown elevation



D-35

APPENDIX E

INFORMATION AS CONTAINED IN

THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST.	(7) STATE	(8) COUNTY	(9) CONGR DIST.	NAME	(10) LATITUDE (NORTH)	(11) LONGITUDE (WEST)	(12) REPORT DATE DAY | MO | YR
NH	264	NED	NH	011	02				SOUHEGAN RIVER WATERSHED DAM NO 10A	4251.0	7148.2	29JUN79

(13) POPULAR NAME	(14) NAME OF IMPOUNDMENT

(15) REGION	(16) BASIN	(17) RIVER OR STREAM	(18) NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	(19) DIST FROM DAM (MI.)	(20) POPULATION
01	05	MILL BROOK	WILTON	1	2276

(21) TYPE OF DAM	(22) YEAR COMPLETED	(23) PURPOSES	(24) STRUCTURAL HEIGHT (FT.)	(25) HYDRAULIC HEIGHT (FT.)	(26) IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	(27) IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	DIST	OWN	FED R	PHV/FED	SCS A	VER/DATE
PGRE	1967	C	65	59	2770	49	NED	N	N	N	B	29JUN79

(28) REMARKS

(29) D/S HAS	(30) SPILLWAY CREST LENGTH	(31) SPILLWAY TYPE	(32) SPILLWAY WIDTH (FT.)	(33) MAXIMUM DISCHARGE (FT.)	(34) VOLUME OF DAM (CY)	(35) POWER CAPACITY INSTALLED (MW)	(36) POWER CAPACITY PROPOSED (MW)	(37) NAVIGATION LOCKS NO.	(38) LENGTH (FT.)	(39) WIDTH (FT.)	(40) LENGTH (FT.)	(41) WIDTH (FT.)	(42) LENGTH (FT.)	(43) WIDTH (FT.)	(44) LENGTH (FT.)	(45) WIDTH (FT.)
1	951	U	330	14686	139065											

(46) OWNER	(47) ENGINEERING BY	(48) CONSTRUCTION BY
NHWATER RESOURCES BOARD	USDA SCS	

(49) REGULATORY AGENCY DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

(50) INSPECTION BY	(51) INSPECTION DATE DAY | MO | YR	(52) AUTHORITY FOR INSPECTION
GOLDBERG ZOINO DUNNICLIFF + ASSOC	01MAY79	PUBLIC LAW 92-367 8AUG1972

(53) REMARKS

END

FILMED

8-85

DTIC